US ARMY CORPS
OF ENGINEERS
NEW ENGLAND DIVISION

# INVENTORY INSPECTION REPORT


# COLEBROOK LAKE SERVICE BRIDGE
# COLEBROOK LAKE DAM
# COLEBROOK, CT

**MAY 1995**

**NEW ENGLAND DIVISION**

Lichtenstein

NEW YORK NEW JERSEY PENNSYLVANIA MASSACHUSETTS OHIO CONNECTICUT FLORIDA ALABAMA

BRIDGES HIGHWAYS RAILROADS SITE ENGINEERING DAMS

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I. INTRODUCTION

II. BRIDGE DESCRIPTION AND HISTORY

III. INSPECTION PROCEDURE

IV. FRACTURE CRITICAL EVALUATION

## I. INTRODUCTION

The Colebrook River Service Bridge is located in Colebrook, Connecticut and provides access to the Intake Control Tower for the Colebrook River Dam. The structure was inspected on January 25, 1995.

## II. BRIDGE DESCRIPTION

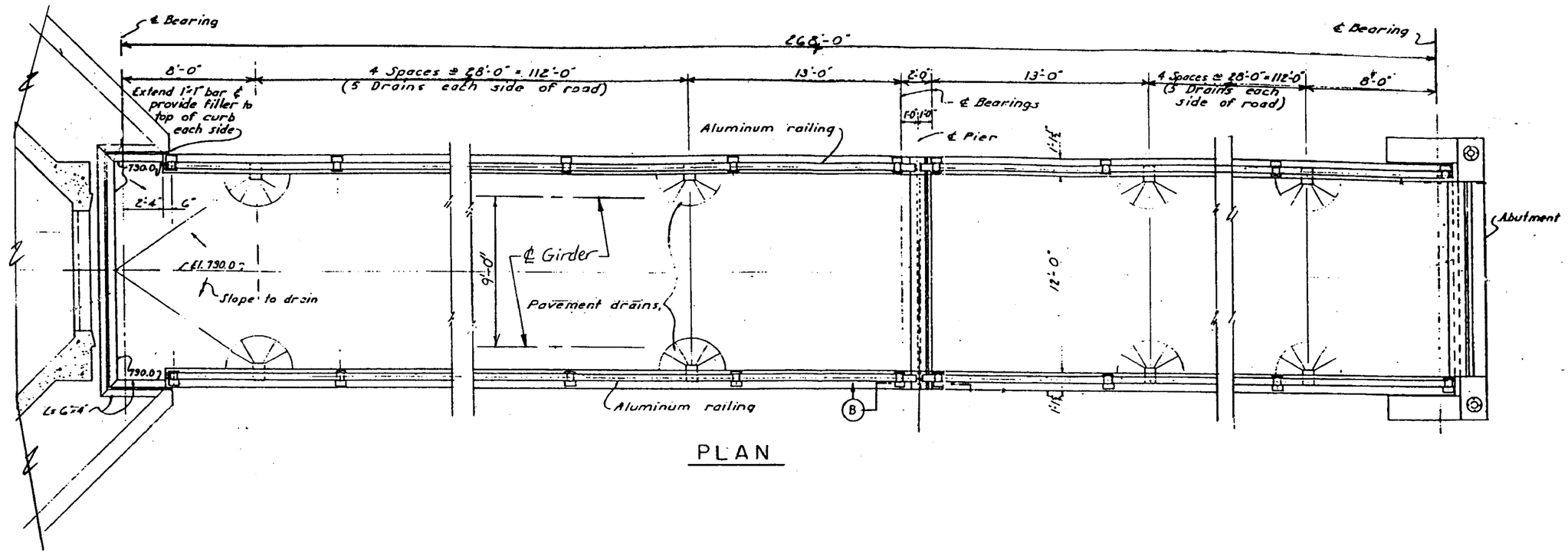
The structure is a 268 foot two-span, two girder plate girder bridge supporting a 9 inch reinforced concrete deck (see Report Photo 1). Both spans are 133 feet 0 inches from centerline support to centerline support with 2 feet between centerline bearings at the pier. The simple span girders are supported by corbels on the Intake Control Tower at the west end, a reinforced concrete pier in the center and a reinforced concrete abutment at the east end. The distance centerline to centerline of girders is 9 feet 0 inches. The spacing of the cross frames, between girders, varies from 15 feet 9 inches to 18 feet 0 inches on center (see General Plan and Elevation, sheet 2). Utilities are suspended from the deck along the center and north side of the structure.

## III. INSPECTION PROCEDURE

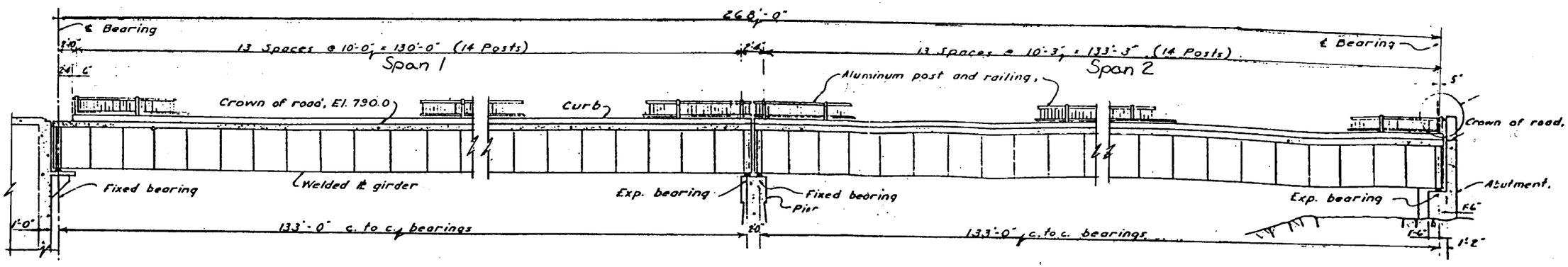
The field inspection included a complete hands-on/visual inspection of all bridge components above ground and water level, excluding the interior of the Intake Control Tower. Special attention was given to fracture critical members. An underbridge inspection unit was utilized to access the underside of the superstructure and portions of the substructure (see Report Photo 2). All pertinent data concerning condition findings of the various bridge elements was recorded on field inspection forms. Color photographs (35mm) were taken and field sketches made to document the typical conditions of the structure as well as any deteriorated areas which deviated from the typical conditions. The complete set of field inspection notes are included in Section VIII - FIELD NOTES of this Report.

## IV. FRACTURE CRITICAL EVALUATION

A Fracture Critical Member (FCM) is a member in tension or with a tension element, whose failure would probably cause a portion of or the entire bridge to collapse. FCM's are subject to fracture due to brittle fracture or fatigue failure. Brittle fracture of a steel member can be caused by the sudden application of a load which causes high total stresses in the presence of a defect in the metal (i.e. nick, notch, crack) and is more likely to occur during cold weather when the steel tends to be more brittle. The formation of a fatigue crack in a steel member is caused by repeated cycles of stress due to live loads. The fatigue life of a steel bridge is dependent on the magnitude of the stress range and the fatigue strength of details. The fracture critical members on this bridge consist of the girders. The girders appear to be in good condition. Further testing does not appear necessary at this time although special attention should be given to these members in subsequent scheduled inspections.




PLAN




SECTION ALONG ℄ OF BRIDGE

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS

COLEBROOK RIVER SERVICE BRIDGE
INVENTORY INSPECTION

Lichtenstein
A.G. LICHTENSTEIN & ASSOCIATES, INC.
CONSULTING ENGINEERS

FILE: D:\COLEGPE.DWG

GENERAL PLAN
AND ELEVATION

SCALE: N.T.S. | DATE: 5/95

# V. SUMMARY OF INSPECTION

## V. SUMMARY OF INSPECTION FINDINGS

The following pages provide a summary of typical conditions found with significant deviations from typical conditions noted. Cross references are made as required to Section VI. - Photographs of this Report which detail specific condition findings.

The evaluations (e.g. "satisfactory", "good", etc.) used in the text of the condition description are based upon the attached *FHWA Structure Inventory, Condition, and Appraisal Rating Guide* sheet included in the Appendix.

### A. Substructure

The bridge substructure was generally in good condition. Isolated locations of minor deterioration due to map cracking and spalling were present on the substructure elements.

The following is a summary of condition findings:

1. Abutment: (GOOD CONDITION)

   The abutment was generally in good condition. The following is a summary of condition findings:

   - 2'-0" and 10" hairline cracks were noted on the backwall.
   - The joint seal was partially missing between the breastwall and backwall.
   - Rust stains on the backwall adjacent to the joint opening were observed.

2. Pier: (GOOD CONDITION)

   The pier was generally in good condition (see Report Photo 3). The following is a summary of condition findings:

   - The pier exhibited 3 spalls, the largest being 4" long by 4" wide by up to 4" deep corner spall on the base.
   - A 15" diameter delamination was noted near the base of the pier of the east face.
   - Rust stains were observed near top of the pier.

3. Intake Control Tower (Exterior only): (GOOD CONDITION)

The Intake Control Tower was generally in good condition (see Report Photo 4) with isolated locations of exposed reinforcing on the walkway surrounding the tower (see Report Photo 5).

## B. Superstructure

The bridge superstructure was generally in good condition (see Report Photo 6). Isolated locations of distress on the superstructure elements are noted as follows:

1. Girders: (GOOD CONDITION)

The girders were generally in good condition. No significant defects were observed.

2. Bearings: (SATISFACTORY CONDITION)

The bearings were generally in satisfactory condition. The following is a summary of condition findings:

- The expansion bearing anchor bolts were bent at the south expansion bearing at the abutment (1 out of 2), the south expansion bearing at the pier (2 out of 2), and the north expansion bearing at the pier (1 out of 2) (see Report Photo 7).

- A gap was observed between the anchor bolt nuts and the anchor bolts on the north fixed bearing at the pier (1 out of 2), the north expansion bearing at the pier (1 out of 2), and the north fixed bearing at the Intake Control Tower (1 out of 2) where the nut was found to be loose (see Report Photo 8).

3. Cross Frames: (GOOD CONDITION)

The cross frames between girders were generally in good condition with no defects observed (see Report Photo 9).

4. Floor System Lateral Bracing: (GOOD CONDITION)

The lateral bracing was generally in good condition with no significant defects observed.

5. Deck/Curb: (GOOD CONDITION)

The deck was generally in good condition with minor areas of concrete distress observed (see Report Photo 10). The following is a summary of the condition findings:

a. Span 1: Top of Deck

- A spall 9" long x 2" wide x up to 1/8" deep was noted at the north curbline (see Report Photo 11).
- Numerous hairline cracks were observed on the deck and curbs, the longest being 10'.

b. Span 2: Top of Deck

- Two minor spalls, up to 3/16" deep, were observed on the deck.
- The deck and curbs exhibited isolated hairline cracks.

c. Spans 1 and 2: Underside of Deck

- The underside of deck was generally in good condition with reinforcing chair rust stains. There were no stay-in-place forms present.

6. Expansion Joints: (SATISFACTORY CONDITION)

The expansion joints were generally in satisfactory condition with the joint sealer partially separated from the expansion plates at both expansion joints (see Report Photo 12).

7. Paint: (GOOD CONDITION)

The paint on the bridge was generally in good condition with no significant problems observed.

8. Miscellaneous:

a. Light Standards: (GOOD CONDITION)

The light standards on the bridge were generally in good condition. No significant defects were observed.

b. Utilities: (GOOD CONDITION)

The utilities on the bridge were in good condition. No defects were observed.

c. Railings: (GOOD CONDITION)

The railings were generally in good condition. No significant defects were observed.

d. Scuppers: (GOOD CONDITION)

The scuppers were generally in good condition. No significant defects were observed.

e. End Posts: (GOOD CONDITION)

The end posts were generally in good condition with an isolated 8" long x 4" wide x up to 3/4" deep corner spall observed at the northeast corner of the south end post.

# VI. PHOTOGRAPHS

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# INVENTORY INSPECTION OF THE COLEBROOK LAKE SERVICE BRIDGE

## COLEBROOK LAKE DAM – COLEBROOK, CT

DATE: MAY, 1995

PROJECT: 1784

PHOTO NO. 1

DESCRIPTION: SOUTH ELEVATION OF BRIDGE.

PHOTO NO. 2

DESCRIPTION: TYPICAL PROCEDURE FOR CLOSE–UP INSPECTION OF SUPERSTRUCTURE.

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# INVENTORY INSPECTION OF THE COLEBROOK LAKE SERVICE BRIDGE

COLEBROOK LAKE DAM – COLEBROOK, CT

DATE: MAY, 1995

PROJECT: 1784

PHOTO NO. 3

DESCRIPTION: EAST ELEVATION OF PIER.

PHOTO NO. 4

DESCRIPTION: EAST ELEVATION OF INTAKE CONTROL TOWER.

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COLEBROOK LAKE DAM – COLEBROOK, CT

DATE: MAY, 1995

PROJECT: 1784

PHOTO NO. 5

DESCRIPTION: EXPOSED REINFORCING ON WALKWAY SURROUNDING THE INTAKE CONTROL TOWER.

PHOTO NO. 6

DESCRIPTION: SUPERSTRUCTURE FRAMING LOOKING WEST.

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# INVENTORY INSPECTION OF THE COLEBROOK LAKE SERVICE BRIDGE

COLEBROOK LAKE DAM – COLEBROOK, CT

DATE: MAY, 1995

PROJECT: 1784

PHOTO NO. 7

DESCRIPTION: NORTH ELEVATION OF NORTH EXPANSION BEARING ON PIER. NOTE BENT ANCHOR BOLT.

PHOTO NO. 8

DESCRIPTION: NORTH ELEVATION OF NORTH FIXED BEARING ON INTAKE CONTROL TOWER. NOTE GAP BETWEEN ANCHOR BOLT NUT AND ANCHOR BOLT.

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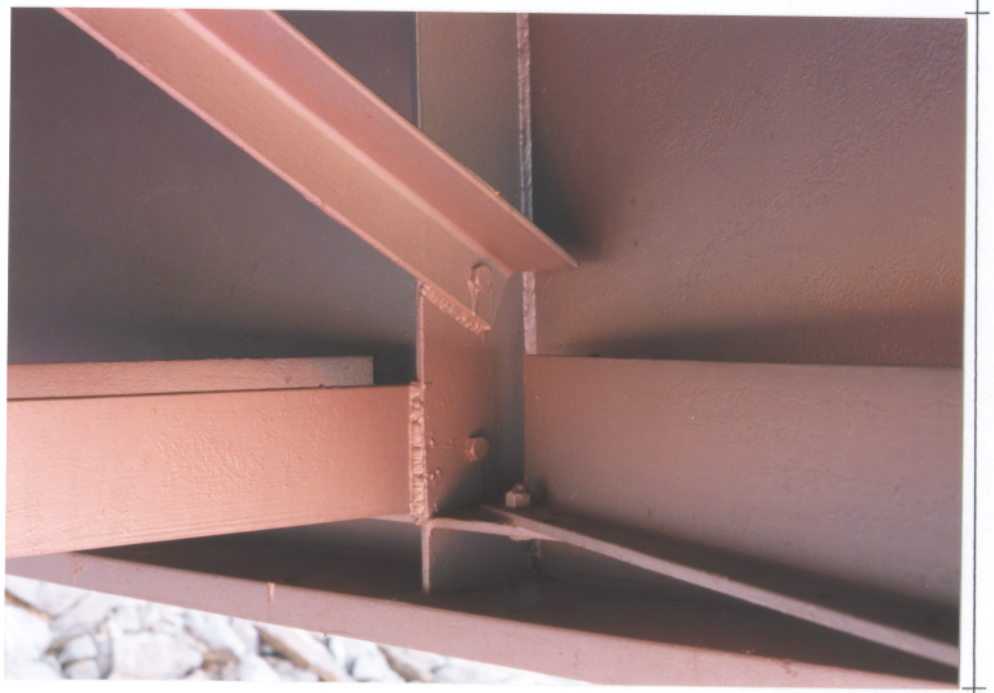
# INVENTORY INSPECTION OF THE COLEBROOK LAKE SERVICE BRIDGE

COLEBROOK LAKE DAM – COLEBROOK, CT

DATE: MAY, 1995

PROJECT: 1784

PHOTO NO. 9



DESCRIPTION: TYPICAL GIRDER TO CROSS FRAME LOWER WELDED CONNECTION.

PHOTO NO. 10

DESCRIPTION: BRIDGE DECK LOOKING EAST.

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# INVENTORY INSPECTION OF THE COLEBROOK LAKE SERVICE BRIDGE

COLEBROOK LAKE DAM – COLEBROOK, CT

DATE: MAY, 1995

PROJECT: 1784

PHOTO NO. 11

DESCRIPTION: MINOR SPALL IN CONCRETE DECK AT NORTH CURB LINE.

PHOTO NO. 12

DESCRIPTION: EXPANSION JOINT AT PIER LOOKING SOUTH. NOTE JOINT SEALER PARTIALLY SEPARATED FROM EXPANSION PLATES.

# VII. CONCLUSIONS AND RECOMMENDATIONS

## VII. CONCLUSIONS AND RECOMMENDATIONS

Based upon the results of the 1995 Inventory Inspection, the Colebrook River Service Bridge is in overall good condition. Isolated locations of satisfactory condition are present on the structure. The following is a list of recommendations:

1. The anchor bolts at the expansion bearings (4 locations) appear to be "bent" toward the contracted position. Based upon our observation, an investigation should be performed to determine the cause of this condition and whether or not the "bent" anchor bolts should be replaced. Our cost estimate is based on replacement of these anchor bolts which would require jacking the existing structure.

2. The anchor bolt nuts at the fixed bearings (2 locations) should be tightened. The nut at the expansion bearing anchor bolt (1 location) should be secured.

3. The joint seal between the breastwall and backwall is partially missing and should be replaced with new joint filler to prevent water runoff onto the abutment seat.

4. The joint sealer at both expansion joints is partially separated from the expansion plates apparently due to the normal expansion and contraction of the joints. The joint sealer should be removed and replaced with new joint sealer to prevent water runoff through the joint.

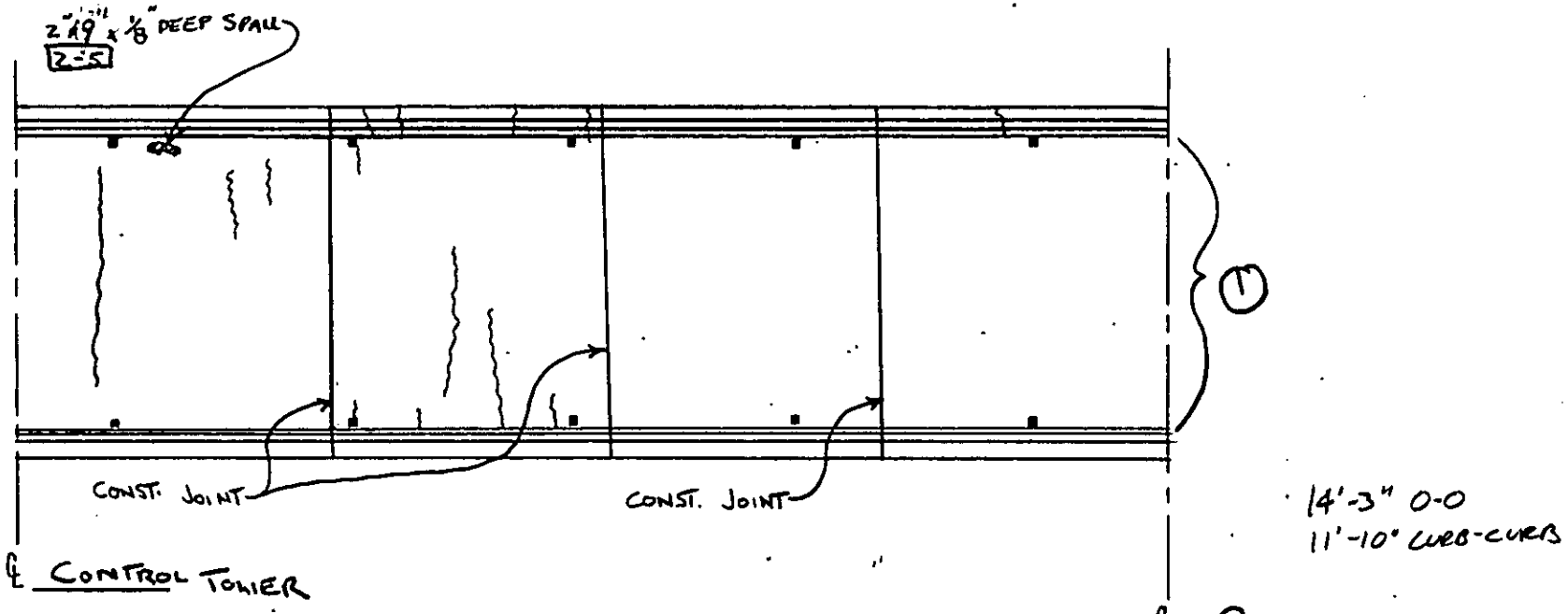
| | Description | Estimated Construction Cost |
|---|---|---|
| a. | Remove and replace bent anchor bolts at expansion bearings (4 locations). | $20,000. |
| b. | Tighten anchor bolt nuts at fixed bearings (2 locations). Secure nut at expansion bearing (1 location). | $ 500. |
| c. | Remove and replace joint filler between breastwall and abutment backwall. | $ 1,000. |
| d. | Remove and replace joint sealer at both expansion joints. | $ 500. |
| e. | Continue regular maintenance schedule. | — |

# VIII. FIELD NOTES

TEMP = 30° F

JOINT OPENING-
TOWER (FIXED) = 1½"
PIER (EXP.) = 3⅛"

N ↑




17
1

14

LEGEND:

} HAIRLINE CRACK

⊗ SPALL

■ - SCUPPER

TOP OF DECK

NOTES: NOTE: ≈ 25% OF DECK COVERED W/ SNOW + ICE 2-3

- CONCRETE DECK
- ALL SCUPPERS CLEAR & FUNCTIONING
- ① SEAL AT JOINT BEGINNING TO FAIL, MEMBRANE PULLING AWAY FROM STEEL 2-6

NOTE; SEVERAL LIGHT SURFACE SCRAPES ON DECK, APPARENTLY FROM SNOW PLOW

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COLEBROOK RIVER DAM
SERVICE BRIDGE

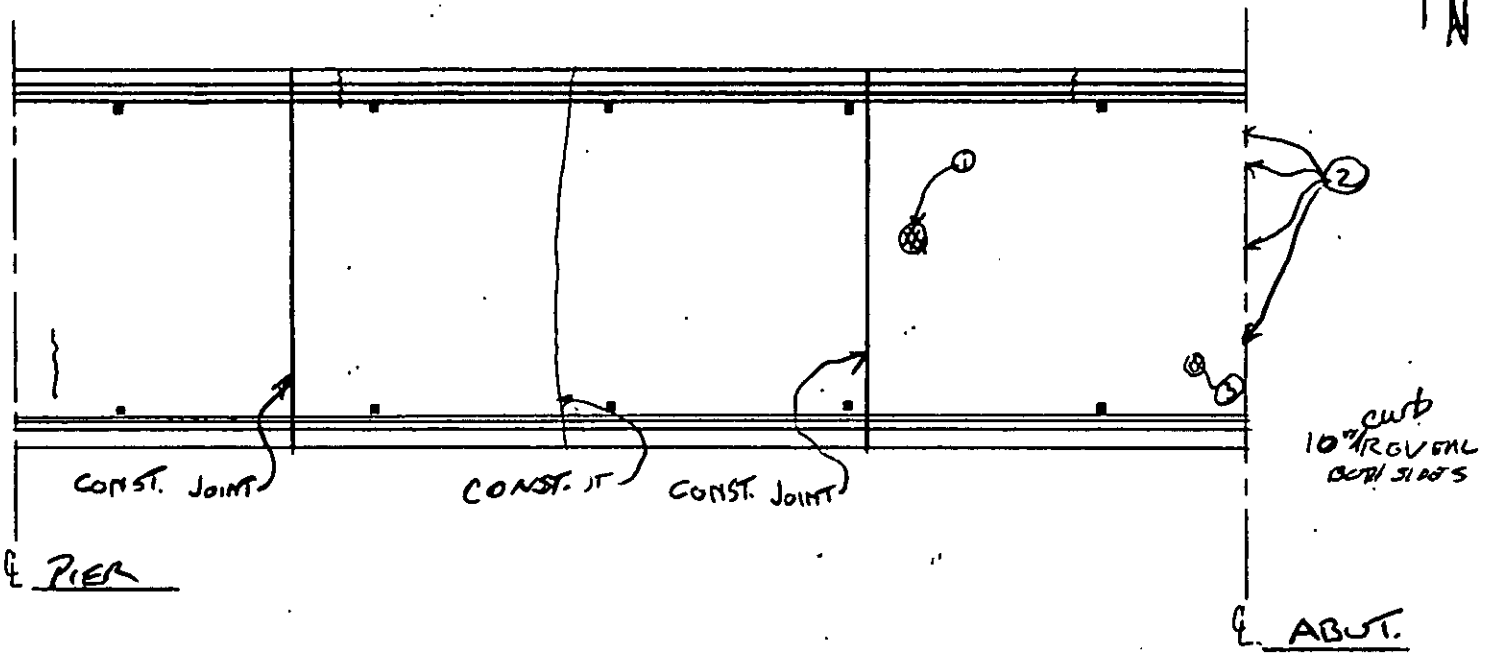
NOTES BY: LICHTENSTEIN
CONSULTING ENGINEERS

JOB #1784 | DATE: 1/25/95

CREW: RWN, BH, P | SHEET 1 OF 7

TEMP = 30°F

DECK JOINT OPENING ABUT (EXP.) = 2 3/8"




LEGEND:

- HAIRLINE CRACK
- SPALL
- ▪ - SCUPPER

NOTES:
① 1½"Ø x 3/16" DEEP SPALL
② UP TO 3" LONG SECTIONS OF JOINT SEAL PULLING AWAY FROM STEEL 2-8,9
③ 2"x1"x1/4" DEEP SPALL

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SERVICE BRIDGE
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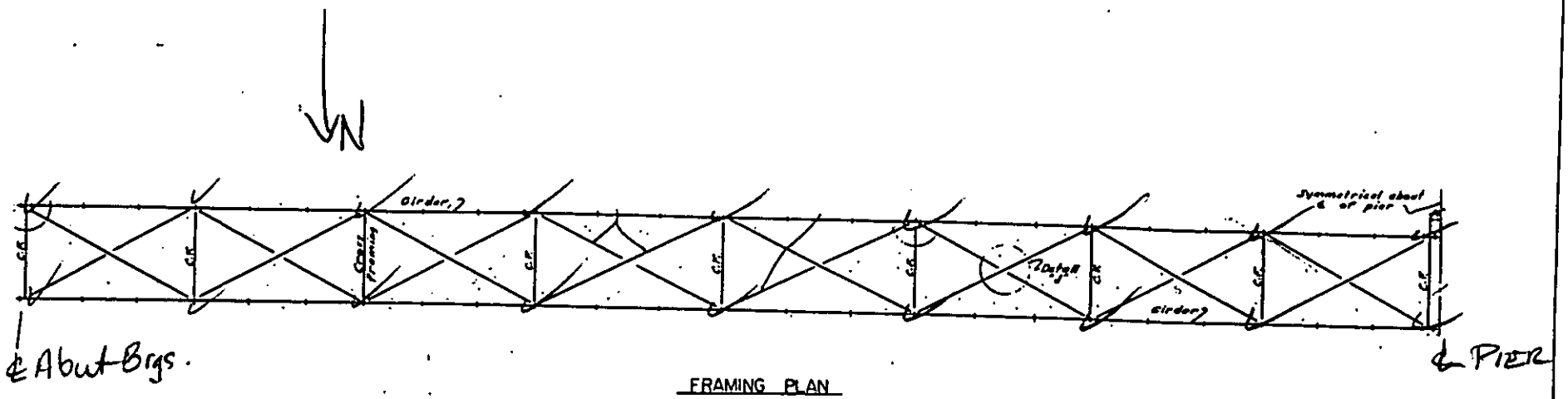
JOB #1784 | DATE: 1/25/25
CREW: RWH, TG, BH | SHEET 2 OF 7




FRAMING PLAN
SPAN 2

3/17

NOTES: Typ. Conditions: - All framing O.K. except as noted on North Girder Elev. sheet, Span 2, (sht. 7 OF 17)
- Underside of deck displays chair rust staining. otherwise in good condition

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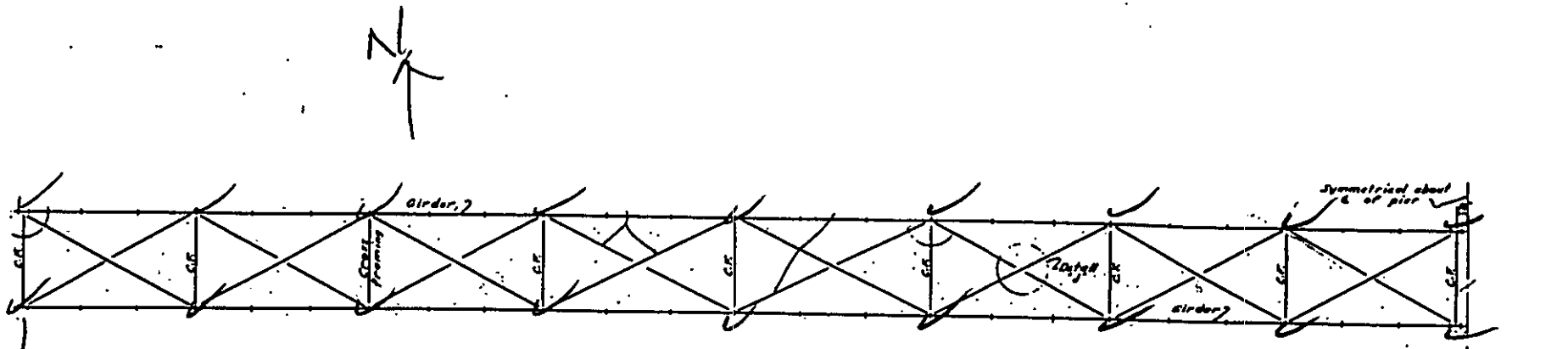
JOB #1784 | DATE: 1/25/95
CREW: BH, PwN, PG | SHEET 3 OF 17




℄ Brg. @ Control Tower

FRAMING PLAN
SPAN 1

℄ PIER

4/17

17

NOTES: Typ. Cond. - All Framing O.K.
- Underside of deck displays chair rust stains, otherwise in good condition.

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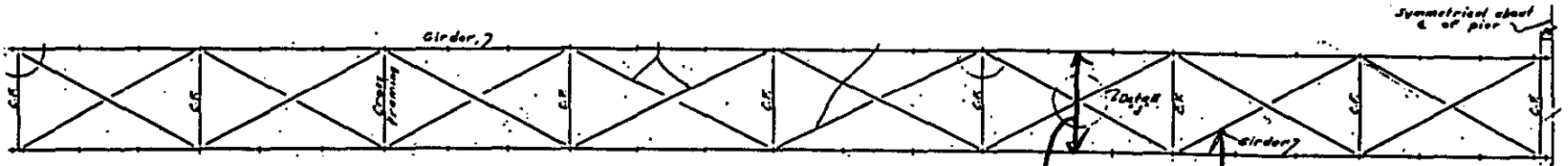
JOB #1784 | DATE: 1/25/95
CREW: BH, AWN, PG | SHEET 4 OF 17

↑N




FRAMING PLAN

9'-0" c-c

6 1/4"

4" t=1 1/2"

T-Section

Typical

5/17

18

NOTES:

| | |
|---|---|
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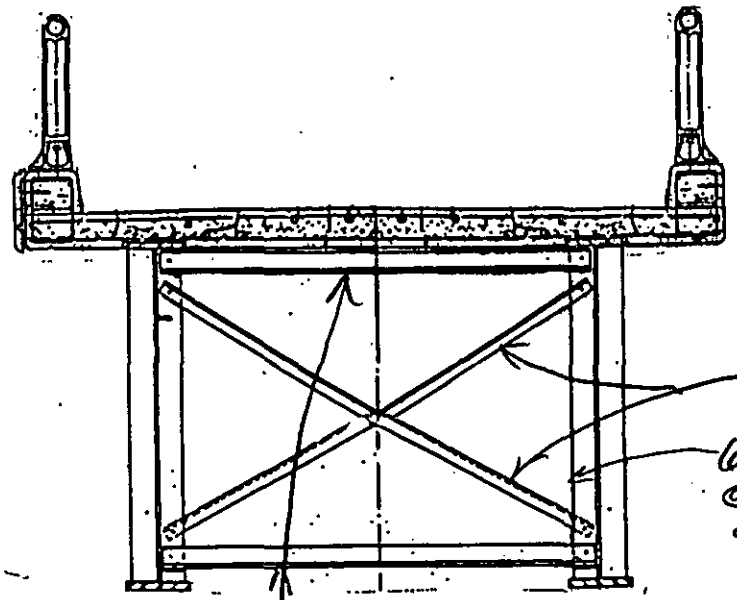
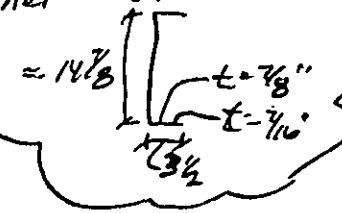
| NOTES BY: LICHTENSTEIN<br>CONSULTING ENGINEERS | |
| JOB #1784 | DATE: 1/25/85 |
| CREW: BH, PAN, PG | SHEET 5 OF 17 |




TYPICAL SECTION

Section @ support is similar except top Lateral member is channel




6 17

19

NOTES:

| | |
|---|---|
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| | COLEBROOK RIVER DAM<br>SERVICE BRIDGE |
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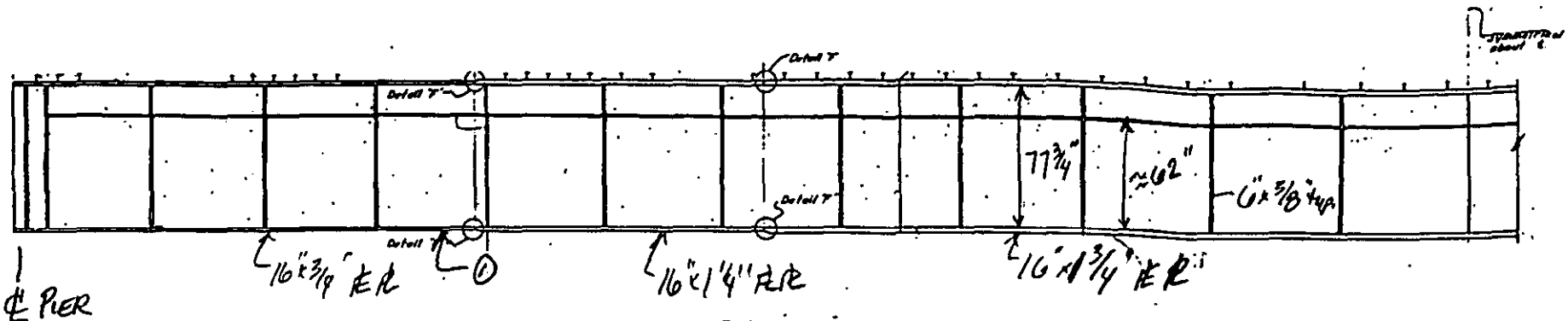
| | JOB #1784 — DATE: 1/25/95 |
| | CREW: BM & PHN — SHEET 6 OF 17 |

West




NORTH GIRDER ELEVATION
SPAN 2

NOTES:

(1) N Bot. flg bows 1/8" ↓ over 16" span. (Tension flg) 1-9

| | |
|---|---|
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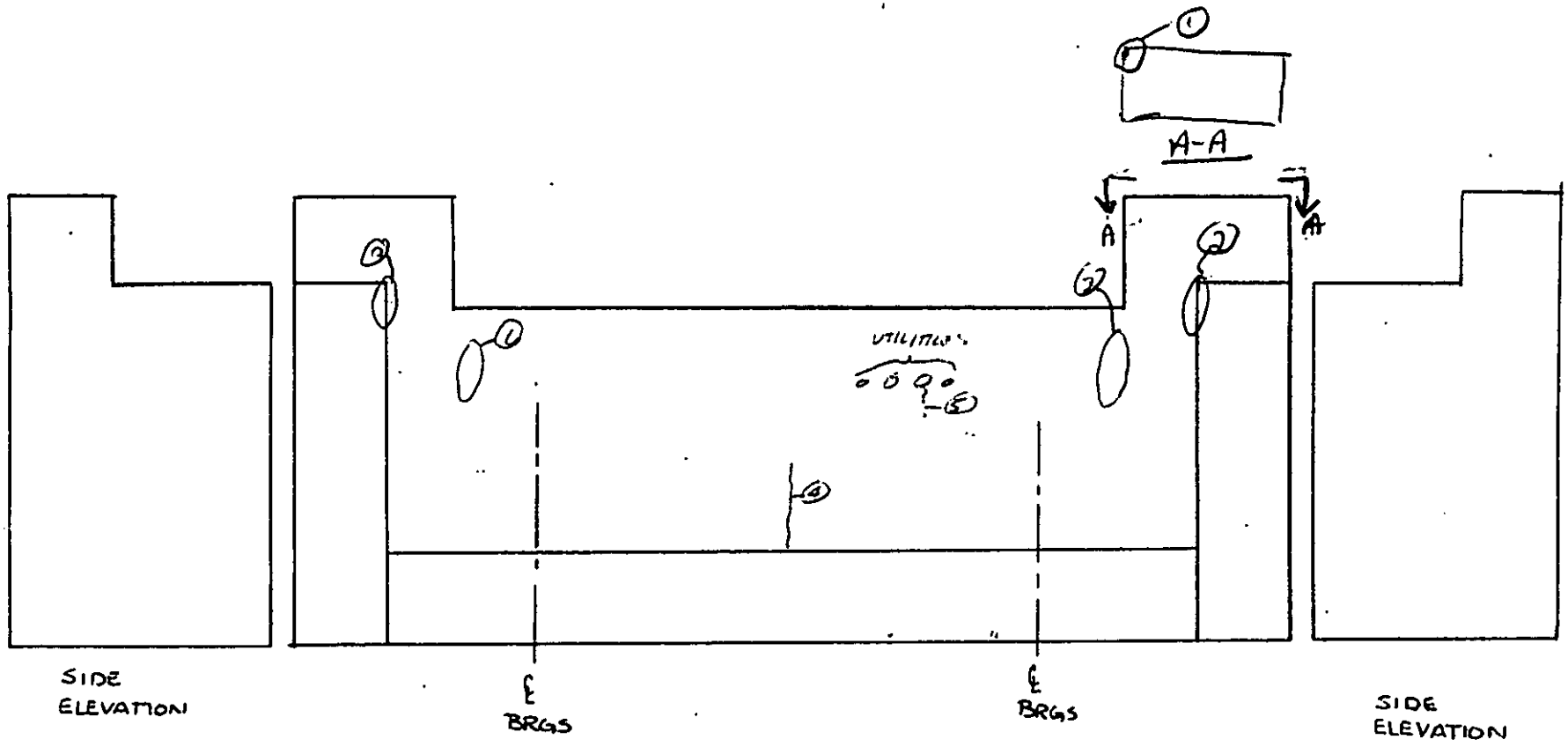
| SERVICE BRIDGE | |
| NOTES BY: LICHTENSTEIN CONSULTING ENGINEERS | |
| JOB #1784 | DATE: 1/25/95 |
| CREW: BH, RG, PWN | SHEET 7 OF 17 |

7/17/20




West Elev.

NOTES:
1. SPALL ON ENDPOST 9" x 4" x 3/8" HIT ? [2-10]
2. JOINT FILLER MISSING & FALLING OUT
3. STAINS ON BACKWALL FROM WATER THROUGH JOINT
4. HAIRLINE CRACK 3' LONG
5. " " FROM UTILITY SLEEVE 10" LONG
6. ICE ON BACKWALL (NORTHSIDE) [2-14]

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COLEBROOK RIVER DAM
SERVICE BRIDGE
NOTES BY: LICHTENSTEIN
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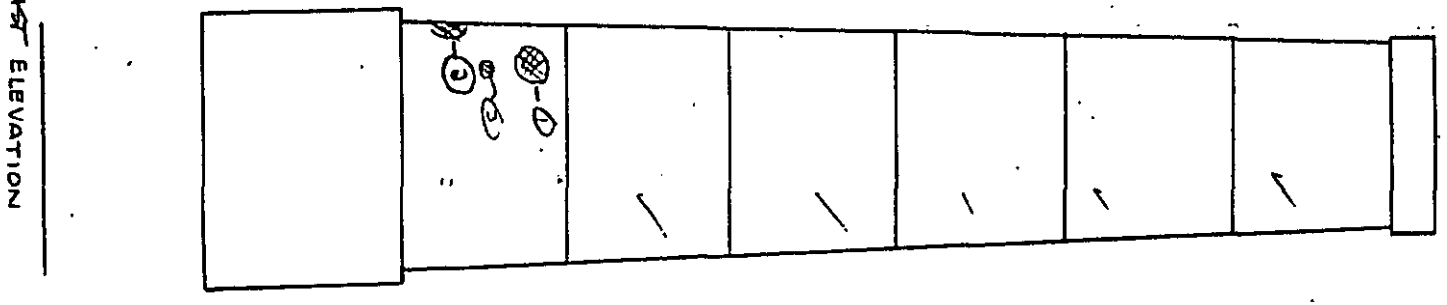
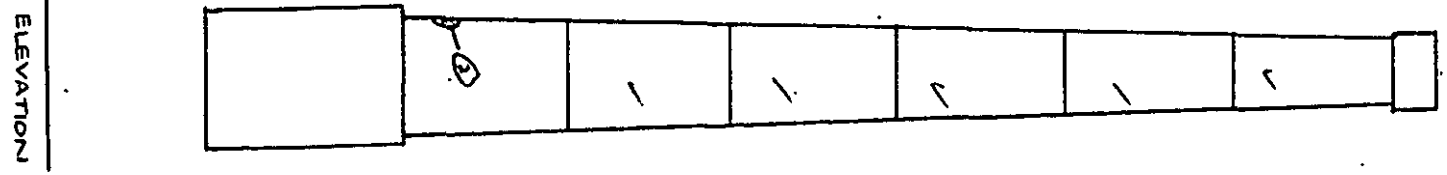
JOB #1784 | DATE: 1/25/95
CREW: PG, RH, DH | SHEET 8 OF 17




SPALLING

NOTES: (1) 15"ϕ HOLLOW [2-15]

(2) 8"X 3" X 1" DEEP SPALL

(3) 4"X 1/2" DEEP SPALL

WATER STAINING AT TOP OF PIER

PIER

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COLEBROOK RIVER DAM
SERVICE BRIDGE

NOTES BY: LICHTENSTEIN
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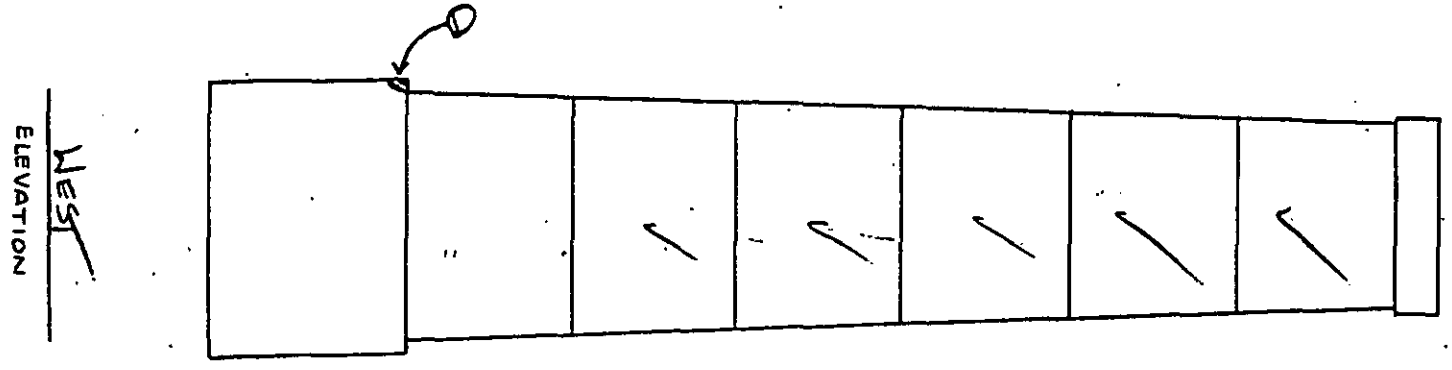
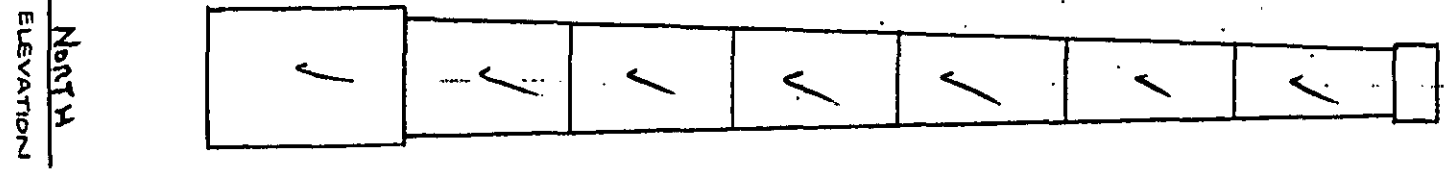
JOB #1784 | DATE: 1/25/95

CREW: PC, BM, PWN | SHEET 9 OF 17

9 17 22




10/17

23

NOTES:

① 4"x4"x4" CORNER SPALL

Top of Pier Cap O.K.

PIER

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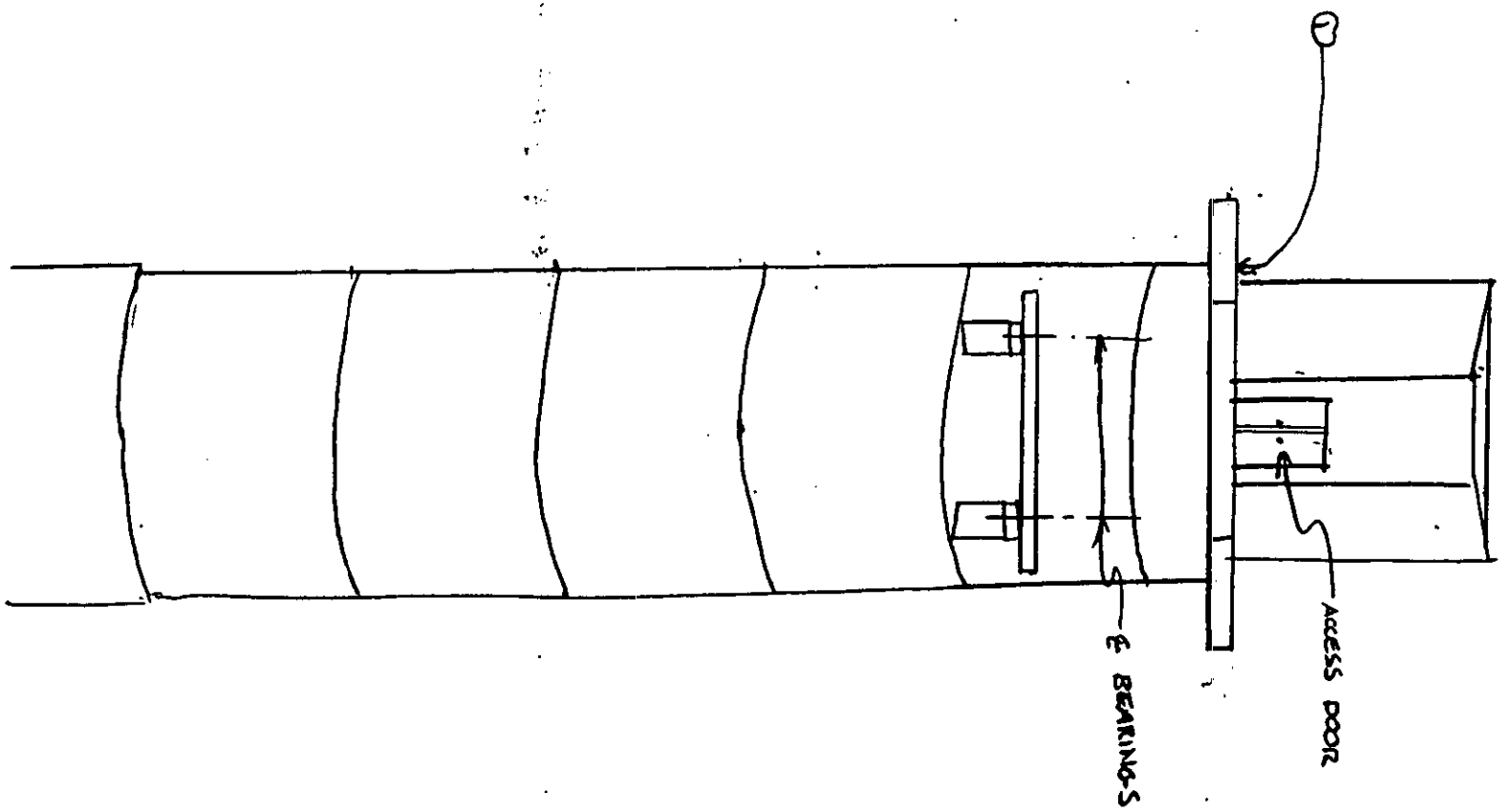
COLEBROOK RIVER DAM
SERVICE BRIDGE

NOTES BY: LICHTENSTEIN
CONSULTING ENGINEERS

JOB #1784 | DATE: 1/25/95

CREW: PMN, BH, EG | SHEET 10 OF 17




NOTES: (1) EXPOSED REINF — NO COVER ON Top of SOUTH SIDE WALKWAY DECK SLAB 2-20

NOTE: INSPECTION OF TOWER WAS LIMITED TO EAST FACE OF TOWER.

INTAKE CONTROL TOWER

DEPARTMENT OF THE ARMY
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COLEBROOK RIVER DAM
SERVICE BRIDGE

NOTES BY: LICHTENSTEIN
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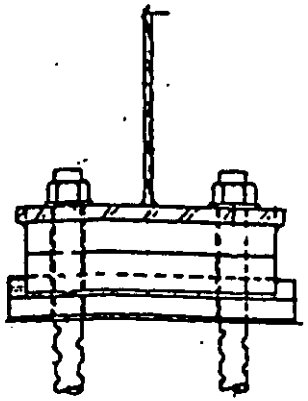
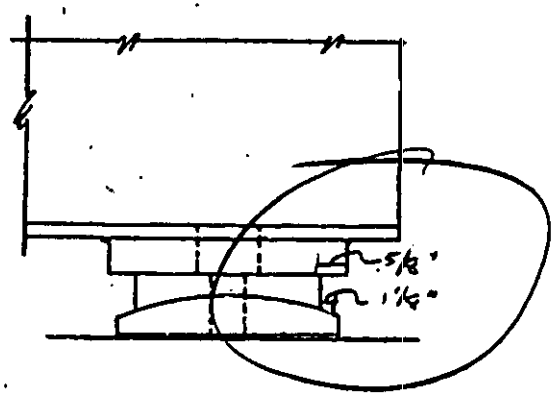
JOB #1784 | DATE: 1/25/95

CREW: RWN, BH, PG | SHEET 11 OF 17

11/17
24






12/17

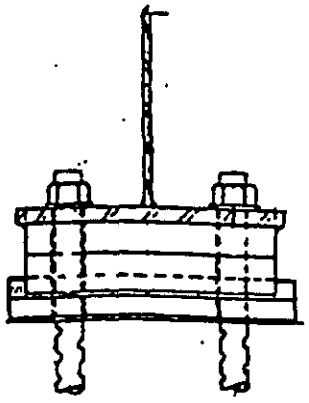
25

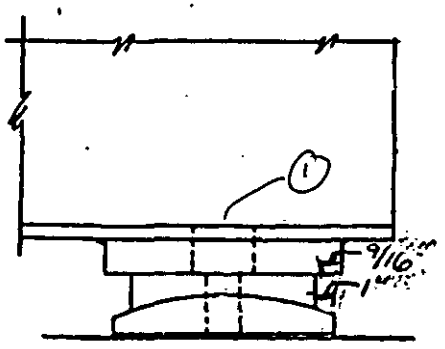
NORTH EXPANSION BEARING @ ABUTMENT

Temp. = 30°F

NOTES:

| | |
|---|---|
| DEPARTMENT OF THE ARMY<br>NEW ENGLAND DIVISION CORPS OF ENGINEERS | |
| COLEBROOK RIVER DAM<br>SERVICE BRIDGE | |
| NOTES BY: LICHTENSTEIN<br>CONSULTING ENGINEERS | |
| JOB #1784 | DATE: 1/25/95 |
| CREW: RWN, RG, DH | SHEET 12 OF 17 |






13/17

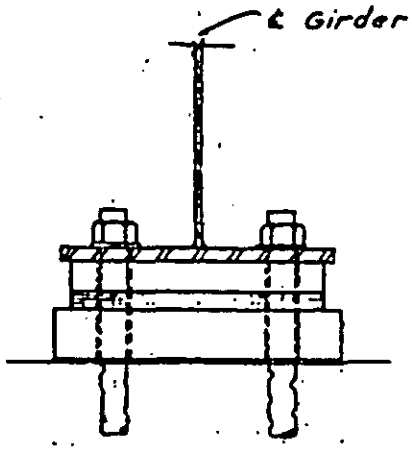
26

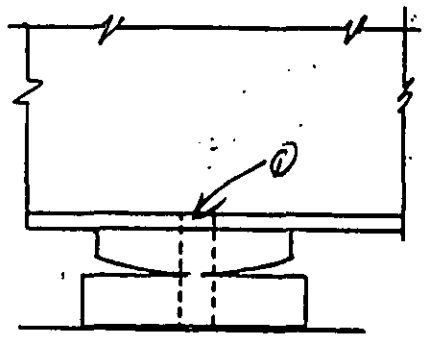
SOUTH EXPANSION BEARING @ ABUTMENT

TEMP - 30° F

NOTES: ① BENT BOLT (Bent west) OUTSIDE OF SOUTH GIRDER AT ABUTMENT 2-13 (S. Anchor Bolt)
DIMENSIONS ON EAST SIDE

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION CORPS OF ENGINEERS
COLEBROOK RIVER DAM
SERVICE BRIDGE
NOTES BY: LICHTENSTEIN
CONSULTING ENGINEERS
JOB #1784 DATE: 1/25/95
CREW: PG, PWN, BH SHEET 13 OF 17



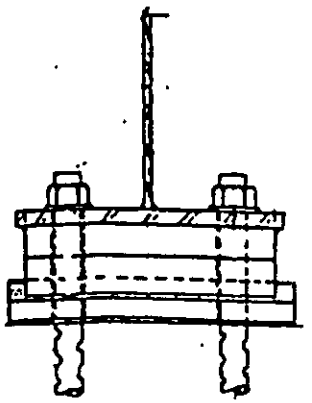

NORTH FIXED BEARING @ PIER

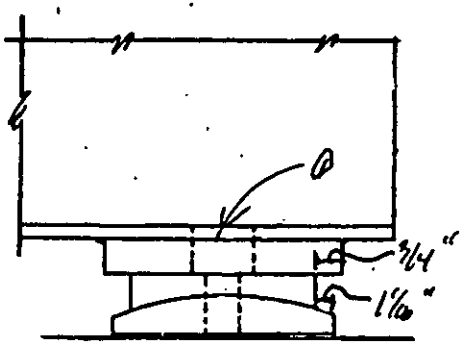
SOUTH FIXED BRG. O.K @ PIER

NOTES:

① North anchor bolt nut unthreaded to top of bolt

| | |
|---|---|
| DEPARTMENT OF THE ARMY<br>NEW ENGLAND DIVISION CORPS OF ENGINEERS | |
| COLEBROOK RIVER DAM<br>SERVICE BRIDGE | |
| NOTES BY: LICHTENSTEIN<br>CONSULTING ENGINEERS | |
| JOB #1784 | DATE: 1-25-85 |
| CREW: BH, PN, RG | SHEET 14 OF 17 |






15/17

28

SOUTH EXPANSION BEARING @ PIER

TEMP = 30°F

NOTES:

① North-South Anchor Bolt slightly West of vertical
Signs of movement not apparent, paint sealed.

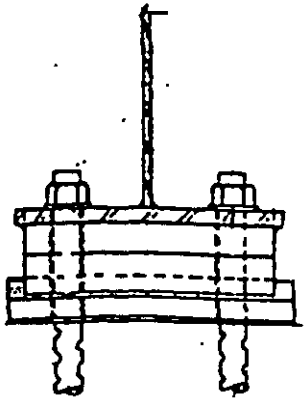
DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION CORPS OF ENGINEERS

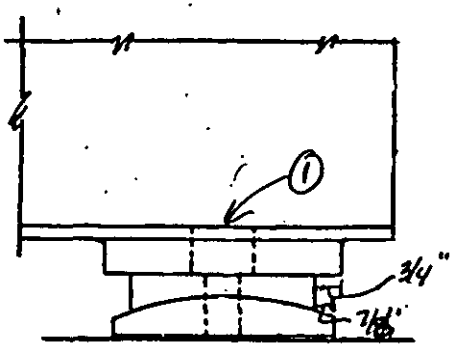
COLEBROOK RIVER DAM
SERVICE BRIDGE

NOTES BY: LICHTENSTEIN
CONSULTING ENGINEERS

JOB #1784 | DATE: 1/25/95

CREW: BH, PHN, PG | SHEET 15 OF 17






16/17

29

## NORTH EXPANSION BEARING @ PIER

TEMP. 30°F

NOTES:

1-14

① North Anchor bolt bent West, South anchor bolt nut not threaded all the way down.

Signs of movement not apparent (paint sealed)

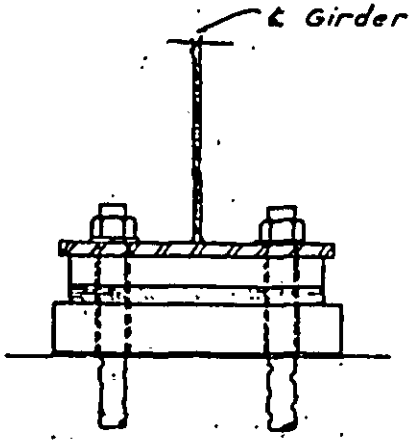
DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION CORPS OF ENGINEERS

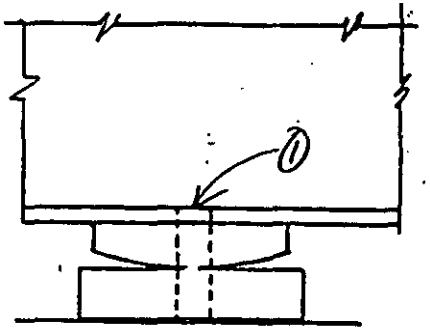
COLEBROOK RIVER DAM
SERVICE BRIDGE

NOTES BY: LICHTENSTEIN
CONSULTING ENGINEERS

JOB #1784 | DATE: 1/25/95

CREW: BH, PAN, PG | SHEET 16 OF 17




17/17

30

NORTH FIXED BEARING @ CONTROL TOWER

SOUTH BRG. O.K. @ CONTROL TOWER

NOTES:

① North Anchor Bolt was loose and almost threaded off [1-20]

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION CORPS OF ENGINEERS

COLEBROOK RIVER DAM
SERVICE BRIDGE

NOTES BY: LICHTENSTEIN
CONSULTING ENGINEERS

| JOB #1784 | DATE: 1/25/25 |
|---|---|
| CREW: TLN, BH, RG | SHEET 17 OF 17 |

# IX. RATING ANALYSIS
## (By Others)

# Service Bridge Rating Analysis

Black Rock Service Bridge (COLEBROOK RIVER LAKE SERVICE BRIDGE
Black Rock Dam IDENTICAL TO BLACK ROCK LAKE
Thomaston CT SERVICE BRIDGE)

3 May 1994

**Vehicle:** HS-20

**Rating Summary:**

| | Inventory | Operating |
|---|---|---|
| Deck | 19.0 | 31.6 |
| Girder midsection | 21.6 | 53.1 |
| Girder 1st cutoff | 27.4 | 55.3 |
| Girder 2nd cutoff | 31.4 | 62.0 |

**Rating:**

| | |
|---|---|
| Inventory | 19.0 T |
| Operating | 31.6 T |

NED FORM 223
27 Sept 49

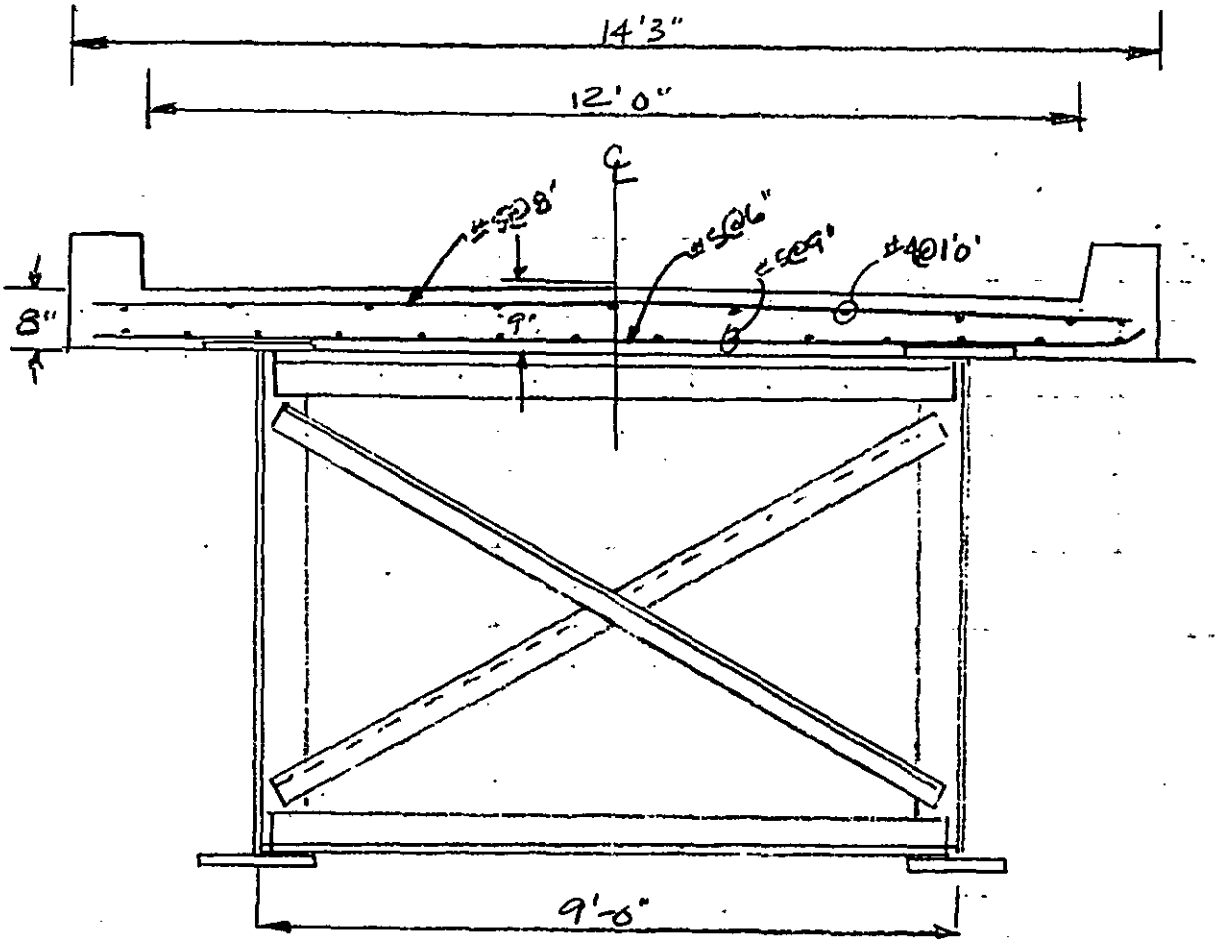
NEW ENGLAND DIVISION
CORPS OF ENGINEERS, U.S. ARMY

PAGE 1

SUBJECT BEAR ROCK SERVICE BRIDGE

COMPUTATION BRIDGE RATING ANALYSIS

COMPUTED BY M.D. CHECKED BY DATE 5-2-94




DECK RATING

GR 40 REINFORCING STEEL

$M_u = \phi M_n$

$= \phi(A_s f_s)(d - a/2)$

$= 0.9(.62)(40)(6.69 - 8/2)$

$a = \frac{A_s f_s}{(.85 f'_c b)} = \frac{.62(40)}{.85(3)(12)} = 0.81$

$d = 8\frac{1}{2} - 1\frac{1}{2} - \frac{5}{16} = 6.69$

$= 140$ k.in

$M_u = 11.7$ k.ft

DEAD LOAD MOMENT CALCULATION

$D = \left(\frac{8\frac{1}{2}"}{12}\right) x1 \text{ k.ft} \times .15 = 0.11$ k/ft

SUBJECT BLACK ROCK SERVICE BRIDGE

COMPUTATION RATING ANALYSIS

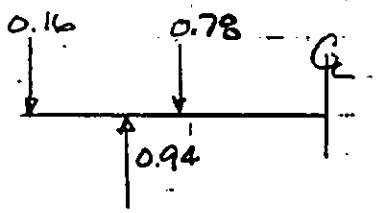
COMPUTED BY MD CHECKED BY DATE 5-2-94

REACTION @ GIRDER.

DECK $\frac{14.25(0.11)}{2} = 0.784$ k.

RAILING + CURBS = 0.16 k

0.94 k.




$M_{℄}$ $-0.16(7.125) - 0.78(3.56) + 0.94(4.5)$
$= -1.14 - 2.78 + 4.23$
$= 0.31$ k.ft

$M_{LL℄} = \left(\frac{S+2}{32}\right)16 = \left(\frac{9+2}{32}\right)16 = 5.5$ k.ft

RATING.

INVENTORY:

$M_U = 1.3[D + 5/3\ RF(L+I)]$ ASSUME IMPACT IS 0

$11.7 = 1.3[0.31 + 5/3\ RF(5.5)]$

RF = 0.95 RATING = (0.95)(20) = 19.0T

OPERATING

$11.7 = 1.3[0.31 + RF(5.5)]$

RF = 1.58 RATING = (1.58)(20) = 31.6T

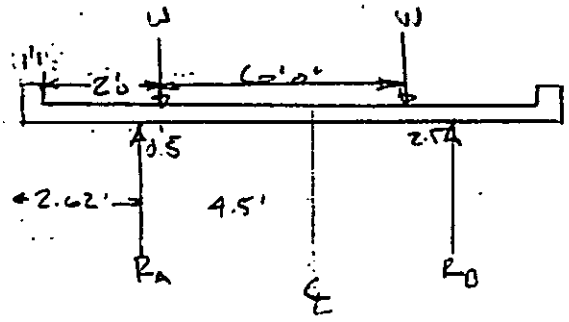
SUBJECT BLACK ROCK SERVICE BRIDGE

COMPUTATION BRIDGE RATING ANALYSIS

COMPUTED BY M.D. CHECKED BY _____ DATE 5-7-99

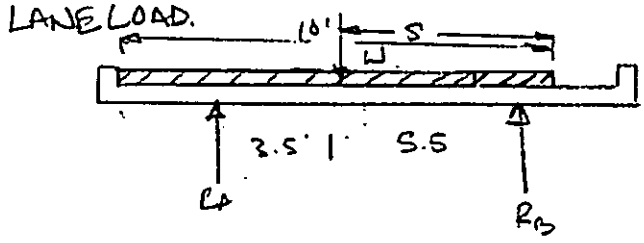
ANALYSIS OF LOADING ON GIRDERS

ANALYSIS BY HS-20 TRUCK LOAD.




$$R_A = \frac{W(2.5) + 8.5(W)}{9} = 1.22W$$

DF = 1.22 × WHEEL LOAD = 0.61 × TRUCK LOAD




$$R_A = \frac{5.5}{9} = 0.61 \times \text{LANE LOAD}$$

TRUCK LOAD WILL GOVERN

TRUCK LOAD @ MIDSPAN.

LOAD ON GIRDER = 2 | 16.9 | 0.61 | = 1291.3 k.ft

PROJECT: BLACK ROCK LAKE
TITLE: SERVICE BRIDGE
DATE: 02-May-94

HS-20 LOADING MOMENTS
WITH LOADING AT ANY POINT

X DIST = THE DISTANCE OF THE CENTER AXLE FROM THE END OF SPAN

CLEAR SPAN 133 ft

| SPAN 133 | LANE @ MID | HS-20 @ MID |
|---|---|---|
| HS-20 LOADING | 2013.6 | 2116.9 |

| LOCATION | X DIST | LANE LOAD AT X | HS-20 AT X |
|---|---|---|---|
| MOMENT AT X1 | 66.50 | 2013.6 | 2114.0 |
| MOMENT AT X2 | 34.00 | 1532.7 | 1624.3 |
| MOMENT AT X3 | 20.50 | 1050.1 | 1084.7 |
| MOMENT AT X4 | 0.00 | 0.0 | 0.0 |

SUBJECT BLACK ROCK SERVICE BRIDGE
COMPUTATION BRIDGE RATING ANALYSIS
COMPUTED BY M.D CHECKED BY DATE 5/2/94

DEAD LOAD ON GIRDERS.

| | | |
|---|---|---|
| GIRDERS. | TOP FLANGE | 68.1 lb/ft |
| | WEB | 99.6 lb/ft |
| | BOT FLANGE. | 95.3 lb/ft |
| | | 263 lb/ft |

DECK = 14'3" X 8½"/2 = 757 lb/ft

STIFFENERS = 15 lb/ft

WIND BRACING Bolted 3 lb/ft

1.04 k/ft

$$M_D = \frac{(1.04)(133)^2}{8} = 2299.6 \text{ k-ft}$$

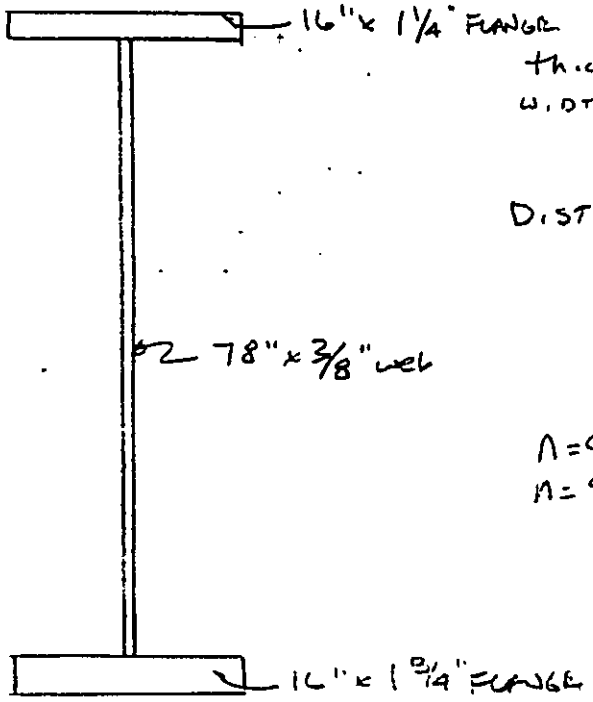
SUPERIMPOSED D

CURB. $(1\frac{1}{12})(13.5/12)(.150)$ = 0.14 k/ft
RAILING 15 lb/ft 0.015
0.155 k/ft
= 0.16 k/ft.

$$M_{SD} = \frac{(0.16)(133)^2}{8} = 353.8 \text{ k-ft}$$

SUBJECT BLACK ROCK SERVICE BRIDGE
COMPUTATION BRIDGE RATING ANALYSIS
COMPUTED BY M.D CHECKED BY DATE 5/2/94

SECTION PROPERTIES OF GIRDER @ MID-SPAN.




EFFECTIVE FLANGE
thickness = 8"
width = $b_f$ = S/2 = 4' = 48"
6(8) = 48"

DIST FROM CURB TO ℄ GIRDER = 2'-6.25"
= 31.5"

$b_f$ = 48" + 31.5" = 79.5"

n = 9 FOR LIVE LOAD
n = 9(3) = 27 FOR SUPERIMPOSED D

SECTION PROPERTIES - in⁴ SEE ATTACHED SPREADSHEET

| | D | Superimposed D n=27 | L n=9 |
|---|---|---|---|
| $S_{Concrete}$ | 0 | 3233 | 6005 |
| $S_{top}$ | 2011 | 3886 | 7856 |
| $S_{bot}$ | 2445 | 2727 | 2909 |

SERVICE BRIDGE RATING ANALYSIS
PLATE GIRDER COMPOSITE SECTION PROPERTIES

PROJECT: BLACK ROCK SERVICE BRIDGE
DATE: 05/02/94
SECTION: MIDSPAN

| SECTION PROPERTIES: CONCRETE | |
|---|---|
| EFFECTIVE FLANGE bf | 79.5 |
| N | 9 |
| SLAB THICKNESS | 8 |

| GEOMETRY: | | |
|---|---|---|
| MEMBER | WIDTH | HEIGHT |
| TOP FLANGE | 16 | 1.25 |
| WEB | 0.375 | 78 |
| BOT FLANGE | 16 | 1.75 |

| TABULATED SECTION PROPERTIES: | | | |
|---|---|---|---|
| STRESS AREA | STEEL ONLY | COMPOSITE W/CREEP | COMPOSITE WO/CREEP |
| S concrete | | 3233 | 6005 |
| S top flange | 2011 | 3886 | 7856 |
| S bot flange | 2445 | 2727 | 2909 |

COMPOSITE STEEL:

| SECTION | AREA | Y | AY | Ic | AY^2 | Ib |
|---|---|---|---|---|---|---|
| BOT FL | 28 | 0.875 | 25 | 7 | 21 | 29 |
| WEB | 29.25 | 40.75 | 1192 | 14830 | 48571 | 63401 |
| TOP FL | 20 | 80.375 | 1608 | 3 | 129203 | 129205 |

| | |
|---|---|
| Y | 36.56 in |
| AY^2 | 103255 in^4 |
| Ic | 89380 in^4 |
| | |
| S top | 2011 in^3 |
| S bot | 2445 in^3 |

COMPOSITE SECTION: LONG TERM WITH CREEP Neff= N*3

| SECTION | AREA | Y | AY | Ic | AY^2 | Ib |
|---|---|---|---|---|---|---|
| STEEL | 77.25 | 36.6 | 2824 | 89380 | 103255 | 192635 |
| CONCRETE | 23.6 | 83.8 | 1977 | 126 | 165532 | 165658 |

| | |
|---|---|
| Y | 47.60 in |
| AY^2 | 228502 in^4 |
| Ic | 129791 in^4 |
| | |
| S con | 3233 in^3 |
| S top | 3886 in^3 |
| S bot | 2727 in^3 |

SERVICE BRIDGE RATING ANALYSIS
PLATE GIRDER COMPOSITE SECTION PROPERTIES

PROJECT: BLACK ROCK SERVICE BRIDGE
DATE: 05/02/94
SECTION: MIDSPAN

COMPOSITE SECTION: LIVE LOAD - NO CREEP Neff= N

| SECTION | AREA | Y | AY | Ic | AY^2 | Ib |
|---|---|---|---|---|---|---|
| STEEL | 77.25 | 36.6 | 2824 | 89380 | 103255 | .192635 |
| CONCRETE | 70.7 | 83.8 | 5921 | 377 | 495894 | 496271 |

| | |
|---|---|
| Y | 59.11 in |
| AY^2 | 516936 in^4 |
| Ic | 171970 in^4 |
| | |
| S con | 6005 in^3 |
| S top | 7856 in^3 |
| S bot | 2909 in^3 |

SUBJECT BUCK ROCK SERVICE BRIDGE

COMPUTATION BRIDGE RATING ANALYSIS

COMPUTED BY M.D CHECKED BY _____ DATE 5-2-94

$M_{LL} = (2116.9 \times .61) = 1291.3$ k.f.

INVENTORY RATING $= \left(\frac{1682.4}{1291.3}\right) 20 = \boxed{26.1\,T}$

OPERATING.

$f_{s\,bot} = 27 - 11.3 - 1.56 = 14.14$ ksi

AVAIL $M_{LL} = 14.14(2509)/12 = 3427.8$ k.f.

OPERATING RATING $= \left(\frac{3427.8}{1291.3}\right) 20 = \boxed{53.1\,T}$

SUBJECT BLACK ROCK SERVICE BRIDGE
COMPUTATION BRIDGE RATING ANALYSIS
COMPUTED BY M.D CHECKED BY DATE 5/2/94

DEAD LOAD (DO CALC FOR SECTION)

$f_{s\ top} \frac{M}{S} = \frac{2299.6(12)}{2011} = 13.7$ ksi

$f_{s\ bot} \frac{M}{S} = \frac{2288.4(12)}{2445} = 11.3$ ksi

SUPERIMPOSED D

$f_{s\ conc} = \frac{M}{S} = \frac{353.8(12)}{3233(27)} = 0.05$ ksi

$f_{s\ top} = \frac{M}{S} \quad \frac{353.8(12)}{3896} = 1.10$ ksi

$f_{s\ bot} = \frac{M}{S} \quad \frac{353.8(12)}{2727} = 1.56$ ksi

ALLOW STRESS FOR LIVE LOAD

$f_{s\ conc} = 1.2 - 0.05 = 1.15$ ksi

$f_{s\ top} = 19.8 - 13.7 - 1.1 = 5.0$ ksi

$f_{s\ bot} = 19.8 - 11.3 - 1.56 = 6.94$ ksi

$M_{MAX} = f_s S_{conc} = 5179.3$ k-ft

$f_s S_{top} = 3273.3$ k-ft

$f_s S_{bot} = 1682.9$ k-ft.

SERVICE BRIDGE RATING ANALYSIS
PLATE GIRDER COMPOSITE RATING

PROJECT: Black Rock Service Bridge
DATE: 05/02/94
SECTION: Mid-Span

| RATING | |
|---|---|
| INVENTORY | 26.1 Tons |
| OPERATING | 53.1 Tons |

| TABULATED SECTION PROPERTIES: | | | |
|---|---|---|---|
| STRESS AREA | STEEL ONLY | COMPOSITE W/CREEP | COMPOSITE WO/CREEP |
| S concrete | | 3233 | 6005 |
| S top flange | 2011 | 3886 | 7856 |
| S bot flange | 2445 | 2727 | 2909 |

| OTHER | |
|---|---|
| Fy STEEL | 36000 |
| f'c CONCRETE | 3000 |
| n | 9 |
| ALLOW fs INVENTORY | 19800 |
| ALLOW fs OPERATING | 27000 |
| ALLOW fc | 1200 |
| DISTRIBUTION FACTOR | 0.61 |

| MOMENTS k-ft | |
|---|---|
| DEAD LOAD | 2300 |
| SUPERIMPOSED DL | 354 |
| LIVE LOAD | 2117 |

| | | |
|---|---|---|
| DEAD LOAD STRESS | fs top | 13.72 ksi |
| | fs bot | 11.29 ksi |
| SUPERIMPOSED | fc conc | 0.05 ksi |
| DEAD LOAD STRESS | fs top | 1.09 ksi |
| | fs bot | 1.56 ksi |
| AVAILABLE STRESSES | fc conc | 1.15 ksi |
| FOR LIVE LOAD | fs top | 4.99 ksi |
| (INVENTORY) | fs bot | 6.95 ksi |
| AVAILABLE STRESSES | fc conc | 1.15 ksi |
| FOR LIVE LOAD | fs top | 12.19 ksi |
| (OPERATING) | fs bot | 14.15 ksi |

SERVICE BRIDGE RATING ANALYSIS
PLATE GIRDER COMPOSITE RATING

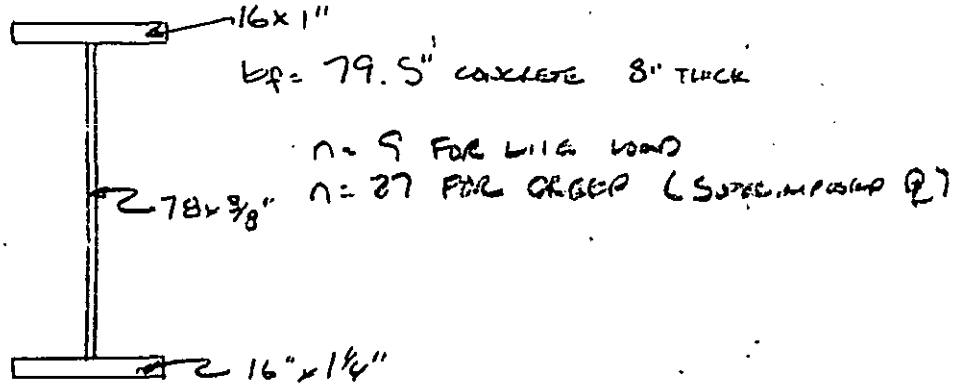
PROJECT: Black Rock Service Bridge
DATE: 05/02/94
SECTION: Mid-Span

| | | |
|---|---|---|
| AVAILABLE LIVE LOAD | M conc | 5179 k-ft |
| MOMENT | Ms top | 3267 k-ft |
| (INVENTORY) | Ms bot | 1685 k-ft |
| | | |
| AVAILABLE LIVE LOAD | M conc | 5179 k-ft |
| MOMENT | Ms top | 7980 k-ft |
| (OPERATING) | Ms bot | 3430 k-ft |
| | | |
| CONTROLLING VALUES | | |
| (INVENTORY) | M max. | 1685 k-ft |
| (OPERATING) | M max. | 3430 k-ft |

SUBJECT BLACK ROCK BRIDGE BRIDGE
COMPUTATION BRIDGE RATING ANALYSIS
COMPUTED BY N.D CHECKED BY _____ DATE 5-2-94

ANALYSE BRIDGE CAPACITY AT CUTOFFS

CUTOFF SECTION :
MEMBER PROPERTIES




$b_f$ = 79.5" CONCRETE 8" THICK

n = 9 FOR LIVE LOAD
n = 27 FOR CREEP (SUPERIMPOSED DL)

SECTION PROPERTIES

| | STEEL ONLY | COMPOSITE W. CREEP | COMPOSITE W/O CREEP. |
|---|---|---|---|
| $S_{CONCRETE}$ | | 2856 | 5474 |
| $S_{TOP}$ | 1668 | 3514 | 7510 |
| $S_{BOT}$ | 1874 | 2142 | 2301 |

DL MOMENT @ 1ST CUTOFF 34' FROM END

$D_L$ = 1.04 K/ft.

$S_{DL}$ = 0.16 K/FT

$$M_{DL} = \frac{1.04(34)}{2}(133-34) = 1750.3 \text{ k.ft}$$

$$M_{SDL} = \frac{0.16(34)}{2}(133-34) = 269.3 \text{ k.ft}$$

$M_{LL}$ = 1624.3 k.ft. x .61 = 990 k.ft

SERVICE BRIDGE RATING ANALYSIS
PLATE GIRDER COMPOSITE SECTION PROPERTIES

PROJECT: BLACK ROCK SERVICE BRIDGE
DATE: 05/03/94
SECTION: FIST CUTOFF AT 34' FROM END

| SECTION PROPERTIES: CONCRETE | |
|---|---|
| EFFECTIVE FLANGE bf | 79.5 |
| N | 9 |
| SLAB THICKNESS | 8 |

| GEOMETRY: | | |
|---|---|---|
| MEMBER | WIDTH | HEIGHT |
| TOP FLANGE | 16 | 1 |
| WEB | 0.375 | 78 |
| BOT FLANGE | 16 | 1.25 |

| TABULATED SECTION PROPERTIES: | | | |
|---|---|---|---|
| STRESS AREA | STEEL ONLY | COMPOSITE W/CREEP | COMPOSITE WO/CREEP |
| S concrete | | 2856 | 5474 |
| S top flange | 1668 | 3514 | 7510 |
| S bot flange | 1874 | 2142 | 2301 |

COMPOSITE STEEL:

| SECTION | AREA | Y | AY | Ic | AY^2 | Ib |
|---|---|---|---|---|---|---|
| BOT FL | .20 | 0.625 | 13 | 3 | 8 | 10 |
| WEB | 29.25 | 40.25 | 1177 | 14830 | 47387 | 62217 |
| TOP FL | 16 | 79.75 | 1276 | 1 | 101761 | 101762 |

| | |
|---|---|
| Y | 37.79 in |
| AY^2 | 93182 in^4 |
| Ic | 70807 in^4 |
| | |
| S top | 1668 in^3 |
| S bot | 1874 in^3 |

COMPOSITE SECTION: LONG TERM WITH CREEP Neff= N*3

| SECTION | AREA | Y | AY | Ic | AY^2 | Ib |
|---|---|---|---|---|---|---|
| STEEL | 65.25 | 37.8 | 2466 | 70807 | 93182 | 163989 |
| CONCRETE | 23.6 | 83.3 | 1965 | 126 | 163561 | 163687 |

| | |
|---|---|
| Y | 49.86 in |
| AY^2 | 220883 in^4 |
| Ic | 106793 in^4 |

SERVICE BRIDGE RATING ANALYSIS
PLATE GIRDER COMPOSITE SECTION PROPERTIES

PROJECT: BLACK ROCK SERVICE BRIDGE
DATE: 05/03/94
SECTION: FIST CUTOFF AT 34' FROM END

| SECTION PROPERTIES: CONCRETE | |
|---|---|
| EFFECTIVE FLANGE bf | 79.5 |
| N | 9 |
| SLAB THICKNESS | 8 |

| GEOMETRY: | | |
|---|---|---|
| MEMBER | WIDTH | HEIGHT |
| TOP FLANGE | 16 | 1 |
| WEB | 0.375 | 78 |
| BOT FLANGE | 16 | 1.25 |

| TABULATED SECTION PROPERTIES: | | | |
|---|---|---|---|
| STRESS AREA | STEEL ONLY | COMPOSITE W/CREEP | COMPOSITE WO/CREEP |
| S concrete | | 2856 | 5474 |
| S top flange | 1668 | 3514 | 7510 |
| S bot flange | 1874 | 2142 | 2301 |

COMPOSITE STEEL:

| SECTION | AREA | Y | AY | Ic | AY^2 | Ib |
|---|---|---|---|---|---|---|
| BOT FL | 20 | 0.625 | 13 | 3 | 8 | 10 |
| WEB | 29.25 | 40.25 | 1177 | 14830 | 47387 | 62217 |
| TOP FL | 16 | 79.75 | 1276 | 1 | 101761 | 101762 |

| | |
|---|---|
| Y | 37.79 in |
| AY^2 | 93182 in^4 |
| Ic | 70807 in^4 |
| | |
| S top | 1668 in^3 |
| S bot | 1874 in^3 |

COMPOSITE SECTION: LONG TERM WITH CREEP Neff= N*3

| SECTION | AREA | Y | AY | Ic | AY^2 | Ib |
|---|---|---|---|---|---|---|
| STEEL | 65.25 | 37.8 | 2466 | 70807 | 93182 | 163989 |
| CONCRETE | 23.6 | 83.3 | 1965 | 126 | 163561 | 163687 |

| | |
|---|---|
| Y | 49.86 in |
| AY^2 | 220883 in^4 |
| Ic | 106793 in^4 |

SERVICE BRIDGE RATING ANALYSIS
PLATE GIRDER COMPOSITE SECTION PROPERTIES

PROJECT: BLACK ROCK SERVICE BRIDGE
DATE: 05/03/94
SECTION: FIST CUTOFF AT 34' FROM END

S con 2856 in^3
S top 3514 in^3
S bot 2142 in^3

COMPOSITE SECTION: LIVE LOAD - NO CREEP Neff= N

| SECTION | AREA | Y | AY | Ic | AY^2 | Ib |
|---|---|---|---|---|---|---|
| STEEL | 65.25 | 37.8 | 2466 | 70807 | 93182 | 163989 |
| CONCRETE | 70.7 | 83.3 | 5886 | .377 | 489991 | 490368 |

Y 61.43 in
AY^2 513027 in^4
Ic 141330 in^4

S con 5474 in^3
S top 7510 in^3
S bot 2301 in^3

SUBJECT BLACK ROCK SERVICE BRIDGE
COMPUTATION BRIDGE RATING ANALYSIS
COMPUTED BY N. D. CHECKED BY DATE

DEAD LOAD STRESS

$f_D = \frac{M}{S}$

$f_{TOP} = \frac{(1750.3 \times 12)}{1668} = 12.59$ ksi

$f_{BOT} = \frac{(1750.3 \times 12)}{1874} = 11.21$ ksi

SUPERIMPOSED D STRESS

$f_D = M/S$

$f_{CURB} = \frac{269.3(12)}{(2856 \times 27)} = 0.04$ ksi

$f_{TOP} = \frac{269.3(12)}{3514} = 0.92$ ksi

$f_{BOT} = \frac{269.3(12)}{3143} = 1.51$ ksi

STRESS AVAIL FOR LIVE LOAD (INVENTORY)

$f_{CURB} = 1.2 - 0.04 = 1.16$ ksi

$f_{TOP} = 19.8 - 12.59 - .92 = 6.29$ ksi

$f_{BOT} = 19.8 - 11.21 - 1.51 = 7.08$ ksi

AVAIL LL MOM (INVENTORY)

$M_{CURB} = \frac{1.16(5474)}{12}(9) = 4762.4$ K.ft

$M_{TOP} = \frac{6.29(7510)}{12} = 3936.5$ K.ft

$M_{BOT} = \frac{7.08(2701)}{12} = 1357.6$ K.ft ← CONTROLS.

SERVICE BRIDGE RATING ANALYSIS
PLATE GIRDER COMPOSITE RATING

PROJECT: Black Rock Service Bridge
DATE: 05/03/94
SECTION: First cutoff at 34' from end

| RATING | |
|---|---|
| INVENTORY | 27.4 Tons |
| OPERATING | 55.3 Tons |

| MOMENTS k-ft | |
|---|---|
| DEAD LOAD | 1750 |
| SUPERIMPOSED DL | 269 |
| LIVE LOAD | 1624 |

| TABULATED SECTION PROPERTIES: | | | |
|---|---|---|---|
| STRESS AREA | STEEL ONLY | COMPOSITE W/CREEP | COMPOSITE WO/CREEP |
| S concrete | | 2856 | 5474 |
| S top flange | 1668 | 3514 | 7510 |
| S bot flange | 1874 | 2142 | 2301 |

| OTHER | |
|---|---|
| Fy STEEL | 36000 |
| f'c CONCRETE | 3000 |
| n | 9 |
| ALLOW fs INVENTORY | 19800 |
| ALLOW fs OPERATING | 27000 |
| ALLOW fc | 1200 |
| DISTRIBUTION FACTOR | 0.61 |

| | | |
|---|---|---|
| DEAD LOAD STRESS | fs top | 12.59 ksi |
| | fs bot | 11.21 ksi |
| SUPERIMPOSED | fc conc | 0.04 ksi |
| DEAD LOAD STRESS | fs top | 0.92 ksi |
| | fs bot | 1.51 ksi |
| AVAILABLE STRESSES | fc conc | 1.16 ksi |
| FOR LIVE LOAD | fs top | 6.29 ksi |
| (INVENTORY) | fs bot | 7.08 ksi |
| AVAILABLE STRESSES | fc conc | 1.16 ksi |

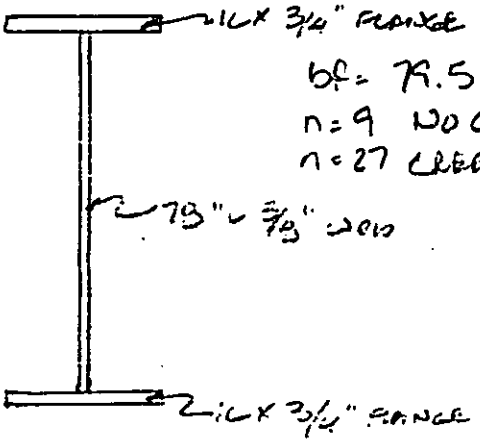
SERVICE BRIDGE RATING ANALYSIS
PLATE GIRDER COMPOSITE RATING

PROJECT: Black Rock Service Bridge
DATE: 05/03/94
SECTION: First cutoff at 34' from end

| | | |
|---|---|---|
| FOR LIVE LOAD | fs top | 13.49 ksi |
| (OPERATING) | fs bot | 14.28 ksi |
| | | |
| AVAILABLE LIVE LOAD | M conc | 4762 k-ft |
| MOMENT | Ms top | 3936 k-ft |
| (INVENTORY) | Ms bot | 1358 k-ft |
| | | |
| AVAILABLE LIVE LOAD | M conc | 4762 k-ft |
| MOMENT | Ms top | 8442 k-ft |
| (OPERATING) | Ms bot | 2738 k-ft |
| | | |
| CONTROLLING VALUES | | |
| (INVENTORY) | M max. | 1358 k-ft |
| (OPERATING) | M max. | 2738 k-ft |

SUBJECT BLACK ROCK SERVICE BRIDGE
COMPUTATION BRIDGE RATING ANALYSIS
COMPUTED BY M.D CHECKED BY DATE 5/3/94

SECTION PROPERTIES @ END CUTOFF




$b_f$ = 7'-5" CONCRETE 8" THICK
n = 9 NO CREEP LIVE LOAD
n = 27 CREEP SUPERIMPOSED DL

SECTION PROPERTIES

| | STEEL ONLY | COMPOSITE W/ CREEP | COMPOSITE W/OUT CREEP |
|---|---|---|---|
| $S_{conc}$ | | 2439 | 4830 |
| $S_{top}$ | 3049 | 3105 | 7131 |
| $S_{bot}$ | 1309 | 1557 | 1688 |

DL MOM @ 20.5' CUTOFF

$D_L$ = 1.04 K/ft
$SD_L$ = 0.16 K/ft

$$M_{D_L} = \frac{1.04(20.5)}{2}(133 - 20.5) = 1199.3$$

$$M_{SD_L} = \frac{0.16(20.5)}{2}(133 - 20.5) = 184.5$$

$$M_{LL} = 1084.7 \times .61 = 661.7$$

SERVICE BRIDGE RATING ANALYSIS
PLATE GIRDER COMPOSITE SECTION PROPERTIES

PROJECT: BLACK ROCK SERVICE BRIDGE
DATE: 05/03/94
SECTION: SECOND CUTOFF AT 20.5' FROM END

| SECTION PROPERTIES: CONCRETE | |
|---|---|
| EFFECTIVE FLANGE bf | 79.5 |
| N | 9 |
| SLAB THICKNESS | 8 |

| GEOMETRY: | | |
|---|---|---|
| MEMBER | WIDTH | HEIGHT |
| TOP FLANGE | 16 | 0.75 |
| WEB | 0.375 | 78 |
| BOT FLANGE | 16 | 0.75 |

| TABULATED SECTION PROPERTIES: | | | |
|---|---|---|---|
| STRESS AREA | STEEL ONLY | COMPOSITE W/CREEP | COMPOSITE WO/CREEP |
| S concrete | | 2439 | 4830 |
| S top flange | 1309 | 3105 | 7131 |
| S bot flange | 1309 | 1557 | 1688 |

COMPOSITE STEEL:

| SECTION | AREA | Y | AY | Ic | AY^2 | Ib |
|---|---|---|---|---|---|---|
| BOT FL | 12 | 0.375 | 5 | 1 | 2 | 2 |
| WEB | 29.25 | 39.75 | 1163 | 14830 | 46217 | 61047 |
| TOP FL | 12 | 79.125 | 950 | 1 | 75129 | 75130 |

Y 39.75 in
AY^2 84138 in^4
Ic 52040 in^4

S top 1309 in^3
S bot 1309 in^3

COMPOSITE SECTION: LONG TERM WITH CREEP Neff= N*3

| SECTION | AREA | Y | AY | Ic | AY^2 | Ib |
|---|---|---|---|---|---|---|
| STEEL | 53.25 | 39.8 | 2117 | 52040 | 84138 | 136179 |
| CONCRETE | 23.6 | 82.8 | 1953 | 126 | 161602 | 161728 |

Y 52.95 in
AY^2 215465 in^4
Ic 82442 in^4

SERVICE BRIDGE RATING ANALYSIS
PLATE GIRDER COMPOSITE SECTION PROPERTIES

PROJECT: BLACK ROCK SERVICE BRIDGE
DATE: 05/03/94
SECTION: SECOND CUTOFF AT 20.5' FROM END

S con 2439 in^3
S top 3105 in^3
S bot 1557 in^3

COMPOSITE SECTION: LIVE LOAD - NO CREEP Neff= N

| SECTION | AREA | Y | AY | Ic | AY^2 | Ib |
|---|---|---|---|---|---|---|
| STEEL | 53.25 | 39.8 | 2117 | 52040 | 84138 | 136179 |
| CONCRETE | 70.7 | 82.8 | 5850 | 377 | 484123 | 484500 |

Y 64.28 in
AY^2 512151 in^4
Ic 108527 in^4

S con 4830 in^3
S top 7131 in^3
S bot 1688 in^3

SUBJECT BLACK ROCK SERVICE BRIDGE
COMPUTATION BRIDGE RATING ANALYSIS
COMPUTED BY M.D CHECKED BY DATE 5/3/94

BRIDGE RATING @ 2ND CUTOFF 23.5' FROM END

DEAD LOAD STRESS

$f_{TOP} = f_{BOT} = \frac{M}{S} = \frac{1199.3(12)}{1309} = 10.99$ ksi

SUPERIMPOSED DL STRESS

$f_{CURB} = \frac{184.5(12)}{(2439 \times 27)} = 0.03$ ksi

$f_{TOP} \quad \frac{184.5(12)}{(3105)} = 0.71$ ksi

$f_{BOT} \quad \frac{184.5(12)}{1557} = 1.42$ ksi

AVAIL STRESS FOR LIVE LOAD

$f_{CURB}$: 1.2 - 0.03 = 1.17 ksi

$f_{TOP}$ = 19.8 - 10.99 - 0.71 = 8.1 ksi

$f_{BOT}$ = 19.8 - 10.99 - 1.42 = 7.39 ksi

AVAIL M MOMENT

M = fS

$M_{CURB}$ = 1.17 (4830 x 9)/12 = 4238 k.ft

$M_{TOP}$ = 8.1 (7131)/12 = 4813.4 k.ft

$M_{BOT}$ = 7.39 (1688)/12 = 1039.5 k.ft

SUBJECT BLACK ROCK SERVICE BRIDGE
COMPUTATION BRIDGE RATING ANALYSIS
COMPUTED BY M.D. CHECKED BY DATE 5/5/94

RATING

INVENTORY

$$\left(\frac{1039.5}{661.7}\right)20 = 31.4T$$

OPERATING

AXIAL STRESS

$27 - 10.99 - 1.42 = 14.59$ K

AXIAL MOMENT

$14.59(1.638)/12 = 2052.3$ k.ft

RATING

OPERATING

$$\left(\frac{2052.3}{661.7}\right)20 = 62.0T$$

SERVICE BRIDGE RATING ANALYSIS
PLATE GIRDER COMPOSITE RATING

PROJECT: Black Rock Service Bridge
DATE: 05/03/94
SECTION: Second cutoff at 20.5' from end

| | | |
|---|---|---|
| FOR LIVE LOAD | fs top | 15.3 ksi |
| (OPERATING) | fs bot | 14.59 ksi |
| AVAILABLE LIVE LOAD | M conc | 4238 k-ft |
| MOMENT | Ms top | 4813 k-ft |
| (INVENTORY) | Ms bot | 1040 k-ft |
| AVAILABLE LIVE LOAD | M conc | 4238 k-ft |
| MOMENT | Ms top | 9092 k-ft |
| (OPERATING) | Ms bot | 2052 k-ft |
| CONTROLLING VALUES | | |
| (INVENTORY) | M max. | 1040 k-ft |
| (OPERATING) | M max. | 2052 k-ft |

SERVICE BRIDGE RATING ANALYSIS
PLATE GIRDER COMPOSITE RATING

PROJECT: Black Rock Service Bridge
DATE: 05/03/94
SECTION: Second cutoff at 20.5' from end

| RATING | |
|---|---|
| INVENTORY | 31.4 Tons |
| OPERATING | 62 Tons |

| MOMENTS k-ft | |
|---|---|
| DEAD LOAD | 1199 |
| SUPERIMPOSED DL | 185 |
| LIVE LOAD | 1085 |

| TABULATED SECTION PROPERTIES: | | | |
|---|---|---|---|
| STRESS AREA | STEEL ONLY | COMPOSITE W/CREEP | COMPOSITE WO/CREEP |
| S concrete | | 2439 | 4830 |
| S top flange | 1309 | 3105 | 7131 |
| S bot flange | 1309 | 1557 | 1688 |

| OTHER | |
|---|---|
| Fy STEEL | 36000 |
| f'c CONCRETE | 3000 |
| n | 9 |
| ALLOW fs INVENTORY | 19800 |
| ALLOW fs OPERATING | 27000 |
| ALLOW fc | 1200 |
| DISTRIBUTION FACTOR | 0.61 |

| | | |
|---|---|---|
| DEAD LOAD STRESS | fs top | 10.99 ksi |
| | fs bot | 10.99 ksi |
| SUPERIMPOSED | fc conc | 0.03 ksi |
| DEAD LOAD STRESS | fs top | 0.71 ksi |
| | fs bot | 1.42 ksi |
| AVAILABLE STRESSES | fc conc | 1.17 ksi |
| FOR LIVE LOAD | fs top | 8.1 ksi |
| (INVENTORY) | fs bot | 7.39 ksi |
| AVAILABLE STRESSES | fc conc | 1.17 ksi |

# X. APPENDIX

## FHWA STRUCTURE INVENTORY, CONDITION, & APPRAISAL RATING GUIDE

**The numerical condition ratings should characterize the general condition of the entire component being rated. They should not attempt to describe localized or nominally occurring instances of deterioration or disrepair. Correct assignment of a condition rating must, therefore, consider both the severity of the deterioration or disrepair and the extent to which it is widespread throughout the component being rated.**

However, in some cases, a deficiency will occur on a single element or in a single location. If that one deficiency reduces the load carrying capacity or serviceability of the component, then the element can be considered a "weak link" in the structure, and the rating of the component should be reduced accordingly.

The following general condition rating guidelines (obtained from the 1988 version of the *Coding Guide*) are to be used in the evaluation of the deck, superstructure, and substructure.

| Code | Description |
|---|---|
| N | NOT APPLICABLE |
| 9 | EXCELLENT CONDITION |
| 8 | VERY GOOD CONDITION - no problems noted. |
| 7 | GOOD CONDITION - some minor problems. |
| 6 | SATISFACTORY CONDITION - structural elements show some minor deterioration. |
| 5 | FAIR CONDITION - all primary structural elements are sound but may have minor section loss, cracking, spalling, or scour. |
| 4 | POOR CONDITION - advanced section loss, deterioration, spalling, or scour. |
| 3 | SERIOUS CONDITION - loss of section, deterioration, spalling, or scour have seriously affected primary structural components. Local failures are possible. Fatigue cracks in steel or shear cracks in concrete may be present. |
| 2 | CRITICAL CONDITION - advanced deterioration of primary structural elements. Fatigue cracks in steel or shear cracks in concrete may be present or scour may have removed substructure support. Unless closely monitored it may be necessary to close the bridge until corrective action is taken. |
| 1 | "IMMINENT" FAILURE CONDITION - major deterioration or section loss present in critical structural components, or obvious vertical or horizontal movement affecting structure stability. Bridge is closed to traffic but corrective action may put bridge back in light service. |
| 0 | FAILED CONDITION - out of service; beyond corrective action. |

# STRUCTURES INSPECTION FIELD REPORT

## INVENTORY INSPECTION

| city/town | bridge dept. no. | 8-structure no. | 90-date inspected |
|---|---|---|---|
| COLEBROOK | | | 0195 |

| 2-dist. | 104-highway system | 22-owner | 27-year built | 106-year rebuilt | 11-milepoint |
|---|---|---|---|---|---|
| | | COE | 1965 | | |

| | |
|---|---|
| 43-structure type: PLATE GIRDER (2 SPANS) | quality control engineer: TOMAS G. STUOPIS, P.E. (MA # 36855) |
| 07-facility carried: SERVICE ROAD TO INTAKE CONTROL TOWER | team leader: ROBERT R. HINDMAN, P.E. (MA # 37800) |
| 06-features intersected: | team members: P. NAGLE, P. GROSSKAMP |

| item 58 DECK | | item 59 SUPERSTRUCTURE | 6 | item 60 SUBSTRUCTURE | 7 |
|---|---|---|---|---|---|
| 1. Wearing Surface | N | 1. Bearing Devices | 6 | 1. Abutments | |
| 2. Deck-Condition | 7 | 2. Stringers | N | a-Wings | 7 |
| 3. Stay in Place Forms | N | 3. Diaphragms | 7 | b-Backwall | 7 |
| 4. Curbs | 7 | 4. Girders or Beams | 7 | c-Bridge Seats | 7 |
| 5. Median | N | 5. Floor Beams | N | d-Breastwall | 7 |
| 6. Sidewalks | N | 6. Trusses | N | e-Footings | N |
| 7. Parapet | N | 7. Rivets or Bolts | N | f-Piles | N |
| 8. Railing | 7 | 8. Welds | 7 | g-Erosion | 7 |
| 9. Anti Missile Fence | N | 9. Collision Damage | 8 | h-Settlement | 7 |
| 10. Drains | 7 | 10. Load Deflection | 7 | 2. Piers or Bents | |
| 11. Lighting Standards | 7 | 11. Member Alignment | 7 | a-Caps | 7 |
| 12. Utilities | 7 | 12. Load Vibration | 7 | b-Column | 7 |
| 13. Deck Joints | 6 | 13. Paint-Epoxy | 7 | c-Web | 7 |
| 14. Approach Settlement | 7 | 14. Year Painted | 90 | d-Footing | N |
| | | 15. Under Clearance ____ ft ____ in | | e-Piles | N |
| | | Clearance Signs ☐ yes ☒ no | | f-Scour | N |
| | | | | g-Settlement | 7 |
| | | | | 3. Collision Damage | 8 |
| | | | | 4. Hydraulic-Adequacy | N |

| | H | 3 | 3S2 | single |
|---|---|---|---|---|
| Actual Posting | ☐ | ☐ | ☐ | ☐ |
| Recommended Posting From Rating Book | ☐ | ☐ | ☐ | ☐ |

Waived Date: _____

| SIGNS IN PLACE | at bridge | advance |
|---|---|---|
| Y or N | ☐ | ☐ |
| LEGIBILITY | ☐ | ☐ |
| NOT APPLICABLE | ☒ | |

Overhead Signs (attached to bridge) ☐ yes ☒ no

1. Welds ☐
2. Bolts ☐
3. Condition ☐

Item93b U/W Inspection Date:

ITEM 61-channel and channel protection: N — ITEM 61 U/W: ☐

| | | | |
|---|---|---|---|
| 1. channel scour | ☐ | 5. rip rap or slope paving | ☐ |
| 2. embankment erosion | ☐ | 6. effectiveness | ☐ |
| 3. fender system | ☐ | 7. debris | ☐ |
| 4. spur dikes & jetties | ☐ | 8. vegetation | ☐ |

36-Traffic Safety features

| | 36 | condition |
|---|---|---|
| 1. bridge railing | ☐ | 7 |
| 2. transitions | ☐ | N |
| 3. approach guardrail | ☐ | N |
| 4. guardrail terminal | ☐ | N |

X=UNKNOWN N=NOT APPLICABLE IA=INACCESSIBLE

## Remarks, Photos and Sketches

| city/town | bridge dept. no. | 8-structure no. | 90-date inspected |
|---|---|---|---|
| COLEBROOK | | | 0195 |

**ACCESSABILITY:**

| Y/N | LIFT BUCKET | BOAT | RAILROAD FLAGMAN | INSPECTOR 60 | OTHER | RIGGING | STAGING | TRAFFIC CONTROL | UNDERWATER INSPECTION | HOURS |
|---|---|---|---|---|---|---|---|---|---|---|
| Y | | | | Y | | | | | | |

**CURB REVEAL:** 10"

**PLANS?** Y/N: Y

**SCOUR:** Y/N: N

**RATING REPORT:**

| Y/N | DATE |
|---|---|
| N | |

**RE-RATE?**

| Y/N | PRIORITY H/M/L |
|---|---|
| N | |